ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 21. No. 8. WEEKLY. | NEW YORK, SATURDAY, OCTOBER 15, 1892. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1892, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

At the end of 1891 there were 18,191 telephone subscribers in France, as compared with 11,140 at the end of 1889.

Telephonic connection was made between New York Police Headquarters and a dozen points along the line of the big Columbus parade last week, for convenience in calling ambulances in case of accidents.

Shortly after President C. A. Coffin's recent return from abroad it was reported that he had sold on the other side from 5,500 to 6,500 shares of his General Electric stock, and that Drexel, Morgan & Company expressed their opinion of the transaction in emphatic language. The *Boston News Bureau* for October 4 said:

"We are able to state on unquestionable authority that Mr. C. A. Coffin, president of the General Electric Company, did not, directly or indirectly, sell a single share of his holdings of General Electric stock during his recent European trip, and has not sold a single share since his return. The rumors recently in circulation in reference to such alleged sale and alleged interview with prominent New York bankers are absolutely without foundation."

The number of stockholders on the Western Union Telegraph Company's books now aggregates over 4,000, the largest number in the history of the company.

Two silly fellows stuck their heads out of a trolley car window night before last. One was instantly killed by a blow upon the head, and the other was struck senseless by the same impact.

Evidently the "trolley must go."

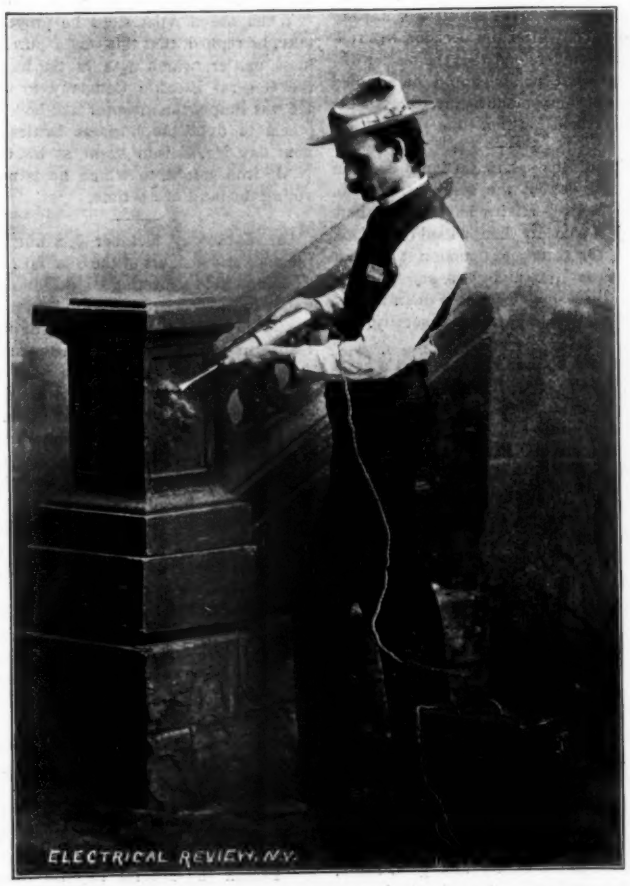
Or, perhaps, it would be just as well for passengers to keep their heads inside of the car, for a blow on the head, whether it be struck by a telegraph pole, the trolley pole or an elevated road support, is apt to leave unpleasant consequences.—*Howard, in the Recorder.*

The United States Lighthouse Board will introduce electric lighting in the lighthouses along the great lakes.

Wall street men are talking a good deal about the exploits of young Coffin, who is virtually the head of the consolidated Thomson-Houston and Edison corporations, and there are stories which indicate that Coffin may be the financial genius of electricity something as Commodore Vanderbilt was of railroad consolidation. If some of the stories are true, Coffin is a dazzler as a speculator, and brokers believe that within the past six months he has made $750,000 through his manipulation of electric stocks. Coffin is a down Easter, and he seems a worthy successor of those brilliant financiers who took the Bell telephone when it was a plaything or curious toy and financed it into one of the most successful of modern corporate efforts. The men who did this were financiers trained after Boston methods, and it is one of the traditions of Wall street that in electrical financing the Bostonians have given and can give the world points. Coffin came to the front through his financing of the corporation with which Professor Thomson is associated as electrician.—*New York Press.*

The Carstarphen Reciprocating Electric Tool for Sculptors.

Mr. W. P. Carstarphen, Jr., of Denver, Colo., is the inventor of an ingenious reciprocating electric tool for sculptors, which is shown in operation in the inventor's hands in the illustration on this page. Mr. Wm. M. Clark, a member of the Electric Club, who has been for the last few years in the West, but is now at the Park Avenue Hotel, this city, has the Eastern interests of the device in his charge. The tool was patented on May 31, 1892, and requires for its operation two or three cells of storage battery, giving four to six volts, and eight to ten amperes of current. It is claimed that one stone carver working with this tool can do as much work in one day as four or five men with chisels and mallets.



CARSTARPHEN'S RECIPROCATING ELECTRIC TOOL FOR SCULPTORS.

The device weighs about six pounds, and is provided with a reciprocating plunger moving within the tubular spools of two coils of insulated copper wire through which a direct current is alternately passed. The current is simultaneously switched from one coil or set of coils to the other by the use of a suitable mechanism located between the two coils, and controlled by the reciprocation of the plunger. The current enters one end of the tool through a revolving swivel, and the rapidity of the strokes made by the plunger is regulated by a button on the side of the tool. The stroke can be made to vary from one-eighth of an inch to one inch, with a rapidity varying from 300 to 600 strokes per minute. With this tool the carver or sculptor, instead of dividing a portion of his attention to striking his chisel, can devote his entire attention to the lines which he is following, thus producing more accurate and rapid work. Although six pounds is the heaviest tool constructed thus far, the principle of the machine can be carried into those of endless variety and size, and suited to all purposes, from the most delicate sculpture work to the heaviest of granite drilling and mine work.

A stock company with ample capital has been formed at Denver to handle the device. The officers of the company are as follows: President, Charles A. Snider, owner of extensive quarries at Manitou; vice-president, H. W. Kirchner, architect; secretary and treasurer, C. W. Buck, and general manager, William P. Carstarphen, Jr.

Some of our electric lights are in the habit of taking an occasional rest, and giving out no light for a night or so at a time. A darkey while passing one of these lamps recently observed the full moon as she was slowly ascending in the eastern sky, and was heard to remark in this wise: "The lectrum light mout shine more louder, but de moon be's more constant."—*Aiken, N. C., Journal and Review.*

THE EDISON DECISION.

The Incandescent Lamp Situation—Various Opinions of the Case—The General Electric Company is Legally On Top at Last—Mr. Edison Smiles and is Gratified—How He Received the News—Outside Lamp Manufacturers are for the Present "On the Fence"—The "Electrical Review," as Usual, Distances Its Contemporaries with the News.

The decision in the great incandescent lamp case, which was handed down by the United States Circuit Court of Appeals on October 4, fell like a bomb into the electrical camp. It was known that the case would be decided about this time, but just when "no fellow could tell." It caught every one by surprise, except the ELECTRICAL REVIEW, which issued a supplement containing this and two other important decisions before 9 o'clock of the same evening. The paper containing this supplement was mailed on time, as usual, reaching our New York city subscribers while they were at breakfast the next morning. The numerous congratulatory messages we have received show how our enterprise in this particular and most important matter was appreciated.

The situation at this writing is decidedly muddled. There are about as many opinions as persons interested. It is too soon to hear from the General Electric Company as to any final policy they may have adopted, although it is probable that a line of action is, and has been for some time, completely mapped out.

Both sides have had since July, 1891, to consider the matter, and it is fairly presumable that Mr. Coffin, president of the General Electric Company, was prepared to act, whichever way the cat jumped. The same is equally true of the manufacturers on the other side. If the patent, which, owing to a British patent, it is claimed will expire in November, 1894, had a longer lease of life, we might expect some very pretty legal struggles. As it now stands, expensive legal battles would not pay in the end. If the General Electric Company wanted to and could collect back royalties, which are estimated by the Edison attorneys at $15,000,000, it would seriously cripple the whole industry. In a word, the situation is picturesquely uncertain and delightfully interesting—to the observer.

Readers of the ELECTRICAL REVIEW who have followed our reports of this important litigation are familiar with the questions at issue and realize the far-reaching influence of this final decision. The evidence and opinions in the case form a library in themselves.

In the ELECTRICAL REVIEW for July 25, 1891, is given a history of the art of incandescent lamp making and Judge Wallace's decision in the great case, which was ren-

dered on July 14, 1891. It was this decision which was appealed from and the present edict of the United States Circuit Court of Appeals, which is the court of last resort in causes of this character, settles the matter once and for all.

This case has been one of the most interesting in the history of patent litigation, equalling in importance the celebrated suit over the telephone patents.

The legal talent employed by both sides has been of the most brilliant and able character. The expenses of the fight have been enormous, the taking of testimony and the trials in various courts extending over a period of 12 years.

This is one of the first causes of magnitude settled by the recently created United States Circuit Court of Appeals, and it will probably be many years before another of equal importance will be placed in judgment.

An interesting phase of the suit, and one which is always apparent to a more or less degree in patent litigation, was the delicate shades of meaning construed from the definitions of words. Probably the most vital word in the whole case was "filament," the Edison attorneys, who were sustained in their position, contending that it meant a thread-like substance, while the other side argued for a broader meaning and endeavored to show that a pencil of carbon might be termed a "filament." In fact, the phraseology of the patent in suit formed the basis of contention.

It is now legally settled for all time that Thomas Alva Edison is the man who first devised and gave to the world an incandescent electric lamp "capable of economical use in factories, large buildings and in smaller buildings contiguous to each other—in other words, available for isolated lighting."

The Westinghouse Interests.

A representative of the REVIEW interviewed several officials of the Westinghouse Electric & Manufacturing Company in relation to the decision. This company owns the Sawyer-Man patent, which failed to knock out Edison's patent. There was not any special dismay discovered on the part of the Westinghouse people; of course, they had all hoped for a different ending of the case, and were disappointed over the result. Just what course would be taken no one was prepared to state. The matter of an accounting, allowed in Judge Wallace's decision and affirmed by the Court of Appeals, is something that the Westinghouse people apparently do not fear. It was claimed that it would be very difficult to decide what the profits amounted to that could be attributed to this one lamp patent—there are probably a hundred other incandescent lamp patents—and accountings generally turned out unsatisfactorily.

It was reported that an agreement had been made between the parties in litigation by which the loser could proceed under a license. This we are informed is not the case. It is reported that the Westinghouse Company is the owner of an incandescent lamp that does not infringe the Edison patent. If this is true, now, if ever, is the time for said lamp to put in its appearance.

The contract for supplying lamps to the World's Fair, it is stated by the Westinghouse people, will not be affected by the decision, as lamps in sufficient quantity are already manufactured and are stored in Chicago ready to be used.

Notes on the Great Incandescent Lamp Case.

The "I-told-you so's" are looming up in great shape.

The Thomson-Houston end of the General Electric Company is more jubilant than the Edison contingent.

General Electric stock rose four points in the afternoon of October 4, the day the decision was rendered.

There are about 20 incandescent lamp manufacturers in the United States outside of the General Electric Company.

The stocks of the central stations throughout the country which use General Electric apparatus should participate in the rise incident to the decision.

It is understood that Mr. George Westinghouse had already arranged, previous to the decision, for a supply of lamps for the World's Fair contract.

How happy the Edison boys would be if this decision had come before the consolidation. Perhaps in that case there would have been no consolidation.

General Electric Company has declared a two per cent. quarterly dividend, payable November 1. Books closed from October 15 to November 1, inclusive.

Wall street men consider the decision of great money value to the General Electric Company. One broker predicts that General Electric should sell up to 150.

As nearly as can be learned, the news of the decision did not reach Wall street in time for any great sums of money to be made in manipulating General Electric stock.

Mr. Edison doubtless feels much elated over the added fame which has come to him. A few months ago he remarked to the editor of the ELECTRICAL REVIEW, "Well, if I didn't invent the incandescent lamp, I never invented anything."

A protracted session of the board of directors of the General Electric Company was held the day after the decision was rendered. It is understood that the matter discussed was what policy should be adopted toward other lamp manufacturers. No decision was reached at that time.

It is difficult to see how the lamp decision can seriously affect the supply trade. In spite of the turn affairs have taken, there will be just as many lamps used as before, requiring for their construction the same amount of platinum and glass, and for their operation the same or greater quantities of wire and electrical apparatus generally.

A Wall street man, who has had a great deal to do with electric stocks, said that he was not pleased with the turn of affairs, as the decision came so quickly and unexpectedly that no one had any time to make much money. "I would advise the purchase of Edison Illuminating stock on the strength of this decision," said he. "I predict that New York Edison Illuminating will sell up to 120 before February, when the dividend will be increased from five to six per cent."

"I have no doubt," remarked a New England lamp manufacturer, "but President C. A. Coffin, of the General Electric Company, had all his plans perfected, and when the decision was announced knew exactly what to do. Had it been in favor of the other side, I am sure he was just as thoroughly ready. He is the ablest man in the electrical field, and while the decision doesn't please me at all, I have great respect for President Coffin's ability and good sense, and don't look for any attempts at arbitrary and unjust proceedings on his part."

One of the large incandescent lamp manufacturing companies writes as follows:

"The decision is, of course, against us and we can only await to see what action the General Company will now take in the matter of licensing, etc."

Another company was informed by telegraph of the decision, and wired back:

"We are glad of it."

It will be seen that opinions are extremely diverse and that the position of many of the lamp manufacturers, outside of the General Electric Company, may be described as "on the fence."

It is estimated that the lamp factories of the General Electric Company produce about 40 per cent. of all the incandescent lamps used in this country. Is the incandescent lamp a necessity? Can the courts force the General Electric Company to license other manufacturers at a fair royalty? Suppose they were to increase the capacity of their factories until the supply of lamps was equal to the whole demand, could they be forced to license competitors, and could the price of lamps be regulated by legal process? If so, it would take the form of a qualification of a patent, which in its very nature grants a monopoly to the inventor.

The decision came as a surprise and caught nearly everybody napping. The ELECTRICAL REVIEW reached its subscribers on time with a two-page supplement containing a correct synopsis of the decisions in the lamp case, the Brush storage battery case and the Brush-Swan case. The *Electrical World* was out on time with a two page supplement devoted to the lamp case, the other two decisions being ignored. The *Electrical Engineer* appeared on time with no mention of any of the decisions, but followed up the matter a day later with a supplement giving synopsis of the three decisions. As a matter of course the REVIEW distanced all its esteemed contemporaries.

Mr. Edison was found in his private laboratory at Llewellyn Park, N. J., the day after the decision was rendered.

"I have always suspected," said he, with a laugh, "that I was the inventor of the electric lamp, but now I am sure of it. It has taken just 12 years to reach a conclusion, but I guess the matter is settled now for all."

When asked what steps he proposed to take, he replied, that this was a purely business matter, which was in the hands of the General Electric Company to decide. He was simply the inventor and he left it to others to fight the business battles. The next day Mr. Edison spent at his Ogden, N. J., iron mines, to which he is now devoting the most of his time.

On Wednesday, October 5, a number of the district managers of the General Electric Company held a meeting to decide upon a policy in reference to the lamp business. It is said that a suggestion was made that all future users of Thomson-Houston and Edison apparatus be asked to sign a five or ten years' contract to purchase incandescent lamps from the General Electric Company. No advance in the price of lamps was contemplated, but under the five year contract a discount of two per cent. was to be allowed, while under the 10 year contract the discount would be five per cent. This and other suggestions were embodied in a report to the board of directors of the General Electric Company for their action. It is probable that no announcement of the position of the company will be given out for some days yet, although it is said that several injunctions against lamp manufacturers will be asked for immediately.

An electrical engineer, who has been connected at various times with all the large electric companies, and who keeps thoroughly posted on the events of the day, was asked for his opinion on the situation, and said:

"I think the General Electric Company may prosecute a few of the weaker lamp manufacturing companies, but further than that my opinion is that nothing will be done. I believe there is a British patent which expires in about two years which will terminate Edison's United States patent on the incandescent lamp. If this is so, it would not pay the General Electric Company to indulge in much expensive litigation. Had the decision of Judge Wallace, rendered in July, 1891, been final, the Edison Company would have had the other lamp manufacturers at their mercy. But this was not the case, and in the meantime the Edison Company, which was the owner of this valuable patent, was merged into the General Electric Company, thereby producing complications which render a legal fight quite improbable. Furthermore, incandescent lamp manufacturers have had over a year in which to consider the matter, and it is very probable that they have discounted the situation and are prepared for any emergency."

ELECTRIC RAILWAY AND POWER NOTES.

Application has been made to the city council of Brigantine Beach, N. J., for a franchise for an electric railroad.

Hon. James Shanahan has been elected president of the Cayudutta, N. Y., Electric Railroad and J. L. Hees treasurer.

The Milwaukee and Wauwatosa Motor Railway Company has secured all the right of way for extending its State Fair grounds' branch to North Greenfield station.

The Boston and Stoneham, Mass., Electric Street Railway Company has been granted, unanimously, a location for its road by Medford, provided the same be built on or before June 1, 1893.

It is estimated that the gross earnings of the West End Street Railway Company, of Boston, for September, will aggregate $606,000, as against $538,859 for the corresponding period of last year.

The Carbondale, Pa., Traction Company, of which Mr. A. H. Chadbourne is vice-president, has begun the operations of its trolley lines with a rush and the outlook for a continued good business is flattering.

Travel between Bethlehem and South Bethlehem was fully established last week by the electric railway. The rapid transit company is now running its cars to the central portion of the latter town and by October 1 electric cars were expected to be running through all of the principal streets and suburbs.

Secretary Rankine, of the Cataract Construction Company, Niagara Falls, recently stated that it will be January 1 before the tunnel is completed and the wheels in position. He said that by June 1, 1893, the company would be able to deliver to the Cataract Electric Company, of Buffalo, the 10,000 horse-power contracted for by wire, at the northern boundary of Buffalo.

All the howls against the trolley which the press and interested outsiders could make were ineffectual in keeping it out of New York city where electrical cars are now running on surface roads. Ten years from now they will be running in every city of the country that has 20,000 or more inhabitants, and people will then wonder at the shortsightedness that once tried to keep them out.—*Lancaster, Pa., New Era.*

A report is current that the Coraopolis and Neville Island Electric Street Railway Company has sold its franchises to the Pittsburgh and Lake Erie Railroad Company. The residents of the usually quiet Coraopolis are considerably agitated over the matter, as they expected the Coraopolis line would be extended to Pittsburgh, connecting with the street car lines. The company was capitalized at $250,000, $50,000 of which was subscribed in Coraopolis.

Plans and specifications for the new power house of the West End Street Railway were filed at the office of the Pittsburgh Building Inspectors last week. The building is to be a three-story brick and iron structure, 75 by 160 feet, with a brick boiler house in the rear 35 by 80 feet. It is already being built on West Carson street. The first two stories are to be of brick and the third of iron. The builders are the Schultz Bridge and Iron Company, and it is to cost $30,000.

Armour & Company have adopted a novel idea of connecting the different houses and departments of their establishment at the Chicago Stock Yards by an electric railroad. Heretofore pork and other products of the packing houses have been moved from place to place by men with wheelbarrows or in barrels. The electric line does away with the vast amount of work required by the old method and greatly adds to the working facilities of the Armour plant. Every product or other thing to be moved about the yards is put on board the little cars and shipped to any department of the packing houses. The system is simple. It does not interfere with the workmen and has proved to be one of the most valuable of the modern improvements introduced in the packing business in recent years.

The Future of Electrical Power Transmission.

[From *Industries*, London.]

There is no more attractive subject than that of the transmission of power by electrical means. In fact, there is something exceptionally engaging in being able to transmit a thousand horse-power through an apparently inert and passive copper wire, and the electrical transmission of power has for many years been a pet theme, more especially of the popular electrical engineer. The transmission of a hundred thousand horse-power from Niagara to New York is a splendid point for a public lecturer dealing with the wonders of electricity and the greatness of electrical engineering, but to the sober practical man it is not a question of difficulty, but of pounds, shillings and pence. He goes to the root of the matter at once, and asks: "Will it pay?" The extraordinary hold high-pressure transmission has upon the general public was well shown by the Lauffen-Frankfort transmission plant, and before that by the Creil experiments. The Lauffen transmission was generally considered the most important part of the recent Frankfort Exhibition, yet there was no difficulty in it. The truth is that electrical engineers can do many apparently wonderful things; the only difficulty is to get the order. When this or that engineer applies electricity in this or that new direction he deserves credit, not so much for working out new or special apparatus, as for being able to convince sceptically minded people that it will pay, and for getting the scheme carried through. Since electricity has been employed by engineers in a practical way for commercial use, a number of proposals have cropped up. It was commonly predicted, for instance, that electricity was to take the place of steam. This notion was obviously "popular," though it never gained ground in electrical circles. In fact, it did not even live in the daily press for more than ten years. Next we had schemes for utilizing the power of the tides by building large dams. Windmills were to be fixed on prominent hills. The coal and slack was to be burned at the pit's mouth, and the power transmitted to distant towns. The Great Northern Railway was to be worked from a power station in the coal districts. Towns were to have electric tramways in all their streets. Steam and gas engines were to disappear from every city, and power was to be laid on electrically as it is now in a limited way by hydraulic service. All manufacturers requiring power were to have it laid on from central stations, where it could be produced cheaply on a large scale, and even domestic cooking and heating in large towns were to be done electrically. Some of these early dreams are destined never to be fulfilled, but in many cases reality will probably be beyond the most sanguine hopes of the pioneers in these directions. It may, therefore, be well for for us to review the position of electrical transmission of power, and to try and see in what directions developments are to be expected.

In the first place, windmills and tidal dams may be dismissed. The power even of a large windmill is relatively very small and it is uncertain; and the capital outlay needed to construct tidal dams is too great. A tidal dam must be double, so that at low tide power can be obtained by emptying one dam, while at high tide it is produced by filling the other. A single dam cannot give power continuously. We may, therefore, now consider the case of distribution of power in a town, steam engines being employed. If a consumer requires a large power, such as, say, 50 or even 100 horse-power, he can generally produce it as cheaply as a supply company, and thus save the cost of distribution. Trades, as, for example, that of printing, demand small powers such as two or three horse, and this power generally intermittently. At first sight it might appear that there was no comparison in economy between a small gas and a large steam engine. It is very easy to fall into a common error here. Some people continually treat the matter as if the cost of supply from central stations depends only on the coal used. This item is often a very small proportion of the cost of power. The cost of coal is swamped in the expenses of distribution, collection, interest on capital, the fees of directors and consulting engineers, and so on. The result is that it is generally cheaper to employ a gas engine than to take power from a central station. In America small motors have made much more progress. One of the chief reasons is that gas is much dearer in the United States. So is coal, but the higher price of coal increases the price of electrical power a small percentage only. The gas engine is also much more developed in England, perhaps for the same reason. It was thought for a long time that the supply of power would improve the "load factor"; unfortunately, however, the motor load overlaps the maximum lighting load, so that the plant must be large enough to meet the demands of both. Some stations, such as that of the Vestry of St. Pancras, are introducing lower rates for power taken during the day. In America there is a very large business now done in small motors for driving fans. The elevator, too, is there almost a national institution. One of the first requisites, however, is a low price for power; seven pence or eight pence per supply unit is too much. It would certainly pay all electric light stations to supply power cheaply during the day—that is to say, when it is most wanted. To generate power during the day adds very little to the cost of running a station. In the evening, especially in Winter, the motor and lamp loads overlap, and extra plant would, therefore, be necessary, but full price can be charged for the power supplied after sunset. The consumer thus obtains most of his power at a low figure, and, though he pays heavily during the last hour or two of the day, his average price is low. In spite of its overlapping the lighting load, the motor load not only improves the load factor to some extent, but it increases the output of the station with but little extra cost. Mr. Kapp has brought forward the plan of making meters which read less during the day, and if such meters could be introduced commercially they would be of great value in increasing the output of central stations. In short, therefore, though there are not the same opportunities in England as in America, there is every reason to suppose that the supply of power from central stations may be developed to a much greater extent than it is now.

Electrical tramways do not seem to take rapid hold in this country. It must be remembered that the enormous development in America has been largely due to the possibility of using overhead wires. If the culvert of storage battery systems had to be used, the industry would not have grown so fast. The horse car is itself very much more generally used in the United States. In this country most of the towns are old, and the streets are too narrow to admit of tramways being worked properly, while cabs are much more generally used here, many people considering it not "quite the thing" to ride in an omnibus or tramcar. In America the cab is not used to the same extent, and cab fares are ruinously high. The hot summers induce people to jump into a tramcar even if they want to go only a few hundred yards. Electrical tramways in this country are hampered chiefly by the objections to overhead wiring. The culvert system has so far been expensive, and storage battery cars do not come within the subject with which we are at present dealing.

Coming to electric railways, these are a favorite dream of the enthusiast. According to his view the power is to be developed by enormous stationary engines, and the trains are to be provided with motors. This is to give a perfect block system, as well as efficient locomotion, for a train can be controlled from the station as well as from the conductor's van. Before assuming that the steam locomotive is doomed, it may be as well to consider what we are going to replace it with. The modern locomotive is not a clumsy, badly designed, and inefficient machine which can be thrown aside with a sigh of relief. It is one of the most perfect specimens of modern engineering design. The conditions to be filled have been the same for half a century, and we have had 50 years of improvement. Further, the locomotive is large enough to be a very economical heat motor. Its weight is often only a small portion of the total weight of the train, and unless the electric motors are to be placed in the carriages themselves, most of the weight is necessary to give tractive adhesion. A locomotive costs less than £4 per horse-power, and this includes boiler and engine and complete fittings. It is scarcely likely that a power station can be built at £4 per horse-power, including boilers, engines, dynamos, mains and running motors. Two drivers would probably be necessary, even if no firing has to be done, for, as a matter of fact, the fireman does a good deal in the way of looking out. The cost of the driver is also a very small matter. The idea that electric railways will be run with light cars is not worth serious consideration. If light cars are good for electric work they are also good for steam railways, and the fact that heavy cars have survived points to their being the best. Unless the electric motor can compete with the locomotive as at present used, it has no chance in the future. The electrical engineer, or rather the electrician, has so little experience in his new industry, that he is apt to undervalue the experience of others engaged in old industries. He is very prone to think that when he has to do with railways he may throw the work of the past aside and re-design the whole thing from beginning to end. The sound practice in a new industry like electrical engineering is to alter all that must be altered, but at the same time to make use of the experience of the past in everything that need not necessarily be changed. The only development of electric railways that seems promising is in such cases as the South London Electric Railway. Here the necessity for ventilation throws the steam locomotive out of competition. Even here such departures as using small tunnels or narrow gauges may cause very serious difficulties in the future, and check the growth of suburban electric railways by preventing their working in with the ordinary traffic. It must be borne in mind, however, that the electric motor provides much greater facilities for large starting torques than a steam engine. It is also urged that the locomotive is very inefficient because of the high speed of the reciprocating parts of the motion work. There may be something in this, but the success of high speed reciprocating engines, and the gradual movement in that direction, points to the loss being small. A very important experiment will be tried shortly, and we may thus have more definite information on this subject in a few months.

The project of carrying power from the pit's mouth to neighboring factories has not shown much vitality. If the coal is cheap at the pit it is also cheap in the neighborhood, so it is generally as easy to carry coals as to convey electrical power. We believe that the most likely plan would be to carry neither the coal nor the electrical energy, but to make gas and use pipe lines after the manner suggested by Mr. Thwaite in our columns. It must be remembered that the demand for heat is enormously greater than for power, and though it might be cheaper to transmit electrical power than to supply water-gas to a small gas engine, the demand for gas for heating and cooking would make the power question of very little consequence. In the colliery itself there is, of course, a splendid opening for electric transmission. This is because steam engines cannot be used in the workings, and electric transmission is, in such cases, better than compressed air or cables. This branch of engineering is being developed very rapidly, both in this country and abroad.

The question that is at present engaging most attention is that of large transmission of power from waterfalls. Of course, this is not very important in this country, as we have such a poor show of waterfalls, and coal is cheap. In Switzerland, however, coal is very dear and waterfalls are plentiful. The transmission of power from waterfalls is, therefore, developing very quickly. The largest scheme, however, is that of the Niagara Falls. Here, of course, there is unlimited power, and it has only to be drawn off and utilized. The only question is whether there is really the assumed demand for it. In the immediate vicinity there are some factories, and it would be easy to transmit the power to Buffalo, which is a large and flourishing town. But the idea seems to be that if power is supplied to them, factories will spring up, and that the center of gravity of American industry will be shifted towards Lake Erie. It is here tacitly assumed that the cost of power is a serious item in most manufactures, and that industries will develop where power is cheapest. A little examination will show that the power is a very small matter in most cases; and the place where an industry settles down seems to be guided by other considerations. Of course, iron and metallurgical industries are carried on where the ore and coal are to be had. It is chiefly a matter of cost of transit. Matters arrange themselves so that the lightest things have to be carried farthest. Rolling mills, it may be urged, take a great deal of power; but it must be remembered that it costs little, as the boilers are heated by the waste gases from the furnaces. In ordinary industries, such, for instance, as cotton spinning, large engines are certainly employed, but the cost of power is after all a small percentage of the cost of cotton goods. The Manchester cotton spinner has other considerations than power to induce him to stay where he is now at work. Pulping wood takes a good deal of power; but power is generally obtainable from waste wood. Still this is one of the industries that will probably flourish at Niagara. In the smelting of aluminium, again, it is a large item, and there are many other processes in electro-metallurgy which could be carried on cheaply at Niagara Falls. In fact, Niagara is in a convenient part of America, and can be easily connected with the trunk lines of the country, so it has everything in its favor, and there probably will be plenty of customers for the power provided there. It must not be overlooked, however, that coal is cheap in many parts of America, that distances are long, and freights are, therefore, heavy. It is thus cheaper to carry coal to the heavy raw product, and to carry the light product to where it has to be sold, than to carry the heavy raw material to the great waterfall. We must also again insist at this point that the cost of power distributed from a waterfall is not necessarily so much lower than from a steam engine, as the coal is only a small part of the cost of the central station. The factories at Niagara, though the distribution will be on a most favorable scale, will not really obtain their power for nothing, nor will their saving necessarily be so very great.

We believe that the *rôle* electrical transmission will play in the future is less pretentious than some people now picture it, but that it is capable of infinitely greater development than any of the schemes we have discussed. It will displace leather belting in workshops. This may not sound much, but the amount of power transmitted through small belts would, if added up, come to a figure that would astonish even those who revel in the numerous ciphers needed in discussing Niagara problems. Electrical engineers, or rather electricians, have been reproached with being unable to design their machines to fit the work to be done, and with expecting the work to be arranged to fit the motor. This, we think, is deserved. High speed motors are still used with belts or gearing, the motors not being specially designed and made practically integral with the machines they work. In the future, however, we may expect machine tool makers to replace the coned pulley with electric motors. Workshops will no longer be forests of belts. The hum and roar of the counter-shafting will be gone. Machines will be arranged in shops to suit the convenience of the work, and not fit the counter-shafting. And each shop will be fitted with suitable overhead cranes with a clear path over the whole shop. The main engine will be much smaller, as the efficiency of an ordinary system of shafting taken over the whole day is very low. Most likely the motors will be for multiple currents, so that they will be cheap to make and will have no commutators. The generators will then produce multiple currents of several frequencies, and the turner will be able to switch his lathe to run at any of some four speeds, just as with the cone pulley and countershaft. Though the works is not the least likely to take its power from central stations it will run all its machinery from one place, instead of having engines and boilers dotted about to save shafting, as is usual at present. In addition to driving ordinary lathes and planing machines, and so on; portable punching, drilling, boring, and milling machines will be used all over the works. A portable milling machine may sound strange, but in the future, when the flange of the column of a marine engine projects an inch or more beyond the cylinder, a fitter with a hammer and a chisel will not be set to chip it away. A portable milling machine will be attached, and will finish the flanges off in a workmanlike manner in a few minutes.

It may be said that we have taken a gloomy view of the future of electrical power transmission. This is not really the case; as we certainly believe that electric power transmission has a very bright future, but it is most important that a clear understanding should be arrived at as to the directions in which development may be expected. In a new business there is always a chance of making great efforts to extend in the wrong direction and ignoring the most profitable developments.

A Method for Recording the Dates of Inventions.

To the Editor of Electrical Review:

If there were no laws, there would be no lawyers, and *vice versa*. On whom do the lawyers live? On those who have some cause for disputes and seek the protection of the courts to right their wrongs. It is, therefore, necessary to have our rights fully protected if we wish to have justice meted out to us. But how can this be done? Does not every one try, at least, to protect himself to the best of his ability? To this question I am compelled to answer, No.

It is a well-known fact that inventors are not always over-cautious in the performing of their inventions, and even if they are, sometimes all precautions are not taken to insure the accuracy and permanency of the record of the date of the invention. One method for the correction of this evil is to make proper drawings and notes and have them attested by some *friends*. I put this word in italics, as recently a rather peculiar case of what we might call a breach of trust thrust itself upon my notice. A man had invented a rather ingenious device for the manufacture of a certain kind of loosely woven fabric, and had asked one of his employés to attest the date. This was done as requested. A week or so afterwards this workman left the laboratory of his employer, and practically disappeared from public view, but two months later a patent was issued to this man, and the inventor, who had not foreseen this state of affairs, was obliged to see his invention go into the hands of another, for he was unable, through sickness and lack of money, to cope with the owner of the patent, who had formed a company to exploit the invention, which afterwards proved of considerable value. I am glad to say that these cases are rare. But we should have other means for protecting the deserving. All the most successful inventors have seen the value of proper dating, and have taken the utmost precaution to keep their laboratories a secret chamber, wherein only a privileged few were allowed to enter. Many of the larger factories have closed doors against all but their employés, and every one is looked upon with suspicion who dares to enter within the sacred precincts. Cases have been heard of where the workmen themselves were in the employ of other companies, and were being paid for giving ideas that could be picked up here and there. There are constantly new things being undertaken which it is impossible to keep secret. It is of the utmost consideration that certain pieces of work be made, and if a man is not able to feel sure that his ideas will not be transferred to a rival company, he is compelled to have his work done piecemeal at different factories, and put together in his own office or laboratory, until the Patent Office can get hold of it, and protect him from those who are ever anxious to benefit themselves by the work of others. This on the face of it is inconvenient and annoying.

How, then, can we obviate this difficulty? is one of the questions that has at some time or other presented itself to the minds of many who have had charge of a great number of miscellaneous workmen. These men know from experience that all are not to be trusted, and it takes fine discriminating powers to know who to and who not to admit within the walls. It is generally safe to employ workmen who have been tried and not found wanting. This apparently solves the problem, but in reality it does not. Even under these conditions, with the promise of large reward, the most tried have gone astray. What, then, is the remedy? No remedy is infallible, but I submit one which will do away with most of the difficulties and take temptation out of the way of the workmen, by making it impossible for them to appropriate any ideas to themselves or to give them away for a consideration.

There is nothing like system for keeping things in order. At the Krupp iron works, in Essen, the owners have to deal with a vast number of workmen, and they make the discipline equal to that of an army. I am informed that no workman knows what his next door neighbor is doing, or rather he is supposed not to know. How is it possible for this enormous concern to keep any trade secrets? By system; and it is said to be one of the most thorough in the world.

But system alone will not remedy the evil and make the world honest; we must have some arrangement by means of which it is impossible for others to take from us those products of our brains which are ours, and which should be held most sacred, viz., those inventions that are intended to benefit and improve mankind.

In order that our rights should be protected, the patent office was inaugurated, and this department insists that the dates of inventions be accurately and carefully recorded, so that the first idea of the inventor and invention shall be a matter of history. But, as a matter of fact there is, when an interference suit is in the courts, considerable difficulty in ascertaining authentically the exact date of the conception of an idea. The only hope of the inventor is in his note books, and it is he who has the more perfect and complete note books that is more likely to have his statements substantiated. All great inventors have kept accurate notes, and those who have been most successful have been careful enough to have no doubt thrown on the validity of their original conceptions. Cases have been known where the real inventor, for lack of sufficient proof, has failed to obtain what was his right. Is there no way by means of which we could have no possibility of a doubt thrown on the date of our inventions?

I offer a method which will do away to a great extent with this difficulty.

Suppose that you have made an invention, and that it is necessary, in order to protect yourself, to have a record of the date of the invention, the following method will prove of some value:

Set all of your apparatus used in the process of the invention up against a wall. Write out a complete and accurate description of the invention, and place it against the wall or some other convenient background. In order to ensure the record of the date, take a copy of some journal—the Electrical Review, for instance—published at the time, bearing the date of the invention, and set this alongside of the apparatus as it is arrranged. The whole should now be photographed as large as convenient, being sure that every letter in the manuscript comes out sharp and clear.

When the photograph is mounted, have the witnesses sign their names on the surface of the photograph. The date should also be repeated on the surface, being careful to use a permanent ink.

This method would, it seems to me, give pefect satisfaction and lessen the number of difficulties attending the attempts at proving the authenticity of an invention.

A still more satisfactory record may be made by inserting a drawing of the details, with accurate and copious notes. If there is a series of experiments, these photographs may be bound, thus making a complete story of the methods and manner of procedure.

Julian A. Moses.

New York, Sept. 30.

PERSONAL.

Chas. E. Newton, Arthur D. Newton and M. E. Baird were Hartford visitors at the Electric Club last week, and attended the reception given by the Club to the American Electro-Therapeutic Association.

Miss Maud Stone, daughter of Capt. Geo. N. Stone, manager of the Cincinnati telephone exchange, will be married on November 21, to a Mr. Carey, of New York. "Maud S," the famous trotter, was named after Miss Stone.

Mr. Jesse H. Bunnell has recently returned from a very enjoyable trip with the Old-Time Telegraphers throughout the West. The evidences of progress seen in Omaha, Denver and other western cities were of much interest to the entire party. The railroad companies and representatives of the different cities visited entertained the telegraphers in great style and all returned in the best of spirits. Mr. Bunnell's good luck caused him to miss a train which was wrecked. Just why he missed he will tell all inquirers.

Sir J. Whittaker Ellis, ex-lord mayor of London, accompanied by Lady Ellis and his private secretary, P. A. Mence, are staying at the Vendome, in Boston. Lord Mayor Ellis' visit to Boston is for the purpose of making an examination of the different electrical systems in use on the street railways in and about that city, and to get a comprehensive idea of the suburban development. He is accompanied by Hon. Erastus Wiman, of New York. Under the guidance of Chief Engineer Pearson, the party was recently taken through the different departments in the central power station, and Sir Ellis was given an opportunity to examine the machinery and the work in the different shops. After having finished the examination of the station a special car was taken by Vice-President Sargent and his party, and during the afternoon visits were made to the different suburban cities which are reached by the electric system. In the evening the ex-lord mayor dined with Vice-President Sargent.

Interested in Electric Traction.

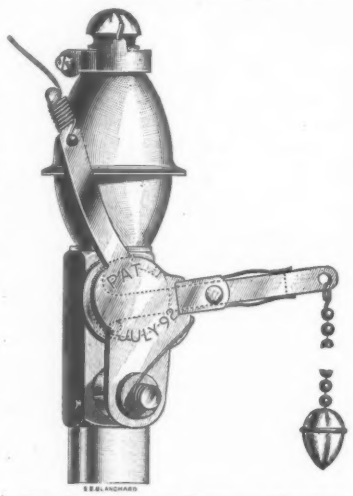
[From *Transport*, London.]

I take the following from a recent issue of the Electrical Review, one of the smartest and best produced journals in New York:

In his address before the Chicago Electric Club, on "Coming Development of Electric Railways," Lieut. F. J. Sprague, one of our ablest authorities on rapid transit, and an electrical engineer of recognized ability, says that within a year there will be in operation in this country five electric locomotives of from 700 to 1,200 horse-power, and weighing from 45 to 80 tons. Such machines will haul trains of 450 tons at 30 miles per hour up a grade of 26 feet to the mile. They will be high speed locomotives operating at a potential about double that now used in electric railway work. The author is of the opinion that such a service as might be furnished by two car trains running at 10 minute intervals, would give the best results on a high speed and long distance line, as, for example, a line between New York and Philadelphia. The suburban service of the Illinois Central Railway, at Chicago, is regarded by Mr. Sprague as an ideal opportunity for an electrical rapid transit installation.

The Iona Safety Pendant Burner.

We illustrate herewith the Iona safety pendant burner, which possesses several novel features. In this burner there is but one contact made in lighting and extinguishing the gas. This result is accomplished by the wipe spring passing over the electrode on its return from the lighting pull, and on



The Iona Safety Pendant Burner.

the off pull by a very ingenious arrangement of the valve cam, the electrode not being touched at all. The on and off pulls are decidedly different, and one can readily tell, even in the dark, whether the gas valve is open or closed. There is no possible danger of mistake on this point. These burners are made in the best possible manner, the valves being hand-ground and always perfectly tight. The movements are simple and positive, and there is no ratchet or complicated springs to get out of order. This burner is being placed on the market by the Redding Electric Company, 41 Federal street, Boston, who have already received a number of large orders from the trade.

New Use for Aluminium.

The variety of new uses which, under the influence of the glut in the aluminium market, caused by the advent of the electric process, has been found for aluminium is very astonishing. We are now told that it has been found that powdered aluminium can be burnt to as good effect as magnesium for lecture-room purposes, while it is considerably cheaper. On the other hand, this aluminium light is not so actinic as magnesium light. The powdered aluminium cannot be satisfactorily burnt in an ordinary spirit lamp, but the best result is obtained by using such a lamp fitted for receiving in the middle of its flame a supply of oxygen, and into which the powdered metal is simultaneously projected by means of a compressible india rubber ball. The best light was secured by burning in this way a mixture of 100 parts of finely-powdered aluminium, 25 parts of lycopodium, and 5 parts of ammonium nitrate. It has been erroneously stated that this mixture leaves no smoke.—*London Electrician.*

The New York Edison Illuminating Company and the Board of Fire Underwriters.

It looked for a time last week as if there would be serious trouble between the Edison Illuminating Company of this city and the Board of Fire Underwriters. The question was over the grounding of the neutral wire of the Edison three wire system, and it was feared that the Board of Fire Underwriters might take such action as would seriously interfere with the electric illumination of the city during the Columbus celebration. The Edison Company prepared the following statement of its side of the question:

The Edison Company uses a low tension current on a system of feeders and mains, which are continuous throughout the whole city, like water and gas mains, so that its customers are not dependent upon a single wire for their supply of light or power. To ask the Edison Company to make the insulation tests and reports which are obtained from the high tension loop circuits is like asking the gas companies or the water purveyor to shut off the supply of water or of gas from all householders to find out whether the pipes are tight.

This is what the Board of Fire Underwriters has done. It has also undertaken to require us to modify our system regarding the third or neutral wire, again refusing to recognize the essential differences between the three-wire system used by this company and the two-wire system used by the high tension companies. The Edison Company has a continuous third wire all through this city, which is purposely touched to the ground at feeder ends. This acts as a sort of safety valve to the entire system, reducing, as we claim, such fire risk as must remain in any light-giving force.

This company does no house wiring whatever, and it requires from all wiring contractors maintenance of the highest possible standard of electric equipment before it turns on current in the house of a customer. The Bureau of Survey, representing the Board of Fire Underwriters, asks the electric light companies to notify it of installations made by these several contractors so that these installations may be inspected before they are connected with a lighting system.

In the present case the Bureau now declines to make the very inspection which it invites, not on the ground that the installation work is not properly done by the contractors, but that it has a difference of opinion with the Edison Company as to how the Edison system should be managed. On this point the Edison Company feels that it is better qualified to judge than the insurance authorities.

The Edison Company employs on its inspecting force twice as many men as the insurance bureau employs for all the electrical companies together, and its inspection is much more thorough and complete.

The fire statistics, of which it has vainly endeavored to obtain an investigation from the board, show that, taking all the fires even attributed to electricity in this city in the past few years, an extremely small proportion were in houses where the Edison system was installed; so that the attempt of the high tension companies, made after public prejudice had been aroused against them by the fatalities resulting from that current, to show that the Edison system was more dangerous in fire risk, fell to the ground on consideration of the facts.

The course of the bureau is more than a wrong to this company, it is unjust to the wiring contractors, who are chiefly engaged in installing for the Edison system, and still more to the customers of the Edison Company, who are among the largest insurers in the city and who are needlessly alarmed by the action of the board and the statements made in interviews with its officers.

The Edison Company will continue to require contractors to come up to the standard of the board rules and of its own regulations, and in view or its belief that the action of the board is unwarranted, and will not be ultimately supported, it is prepared, at the request of those desiring to use electric light, to supply current after its own inspection is completed.

A truce was finally declared and it is probable that an amicable settlement will be reached before long. The Fire Underwriters will not interfere with the Columbus celebration, at any rate. The Edison Company has a splendid reputation for doing first-class work and will doubtless arrange matters satisfactorily to the Underwriters.

The Westinghouse Company must Pay Taxes on its Tangible Property in Pennsylvania.

Justice Heydrick reverses the courts of Dauphin County in the case of the Commonwealth of Pennsylvania against the Westinghouse Electric & Manufacturing Company, and enters judgment in favor of the State in the sum of $6,661.89, being State taxes due on capital stock. After referring to the acts under which the defendant company is chartered, Justice Heydrick says, in general:

"It does not follow that the defendant is taxable upon its entire capital. Part of its capital is invested in patent rights, and that it is not taxable upon that part is so clearly and forcibly shown by the learned court below as to render further discussion of that subject undesirable. It is equally clear that it is not taxable upon another part invested in manufacturing plants situated in New York and New Jersey. This, however, is not controverted, but, in addition to the items upon which the tax was imposed by the judgment of the court below, it is taxable upon so much of its tangible property as is situated in this Commonwealth."

MEDICAL ELECTRICITY.

EDITED BY DR. J. MOUNT BLEYER, NEW YORK.

The Second Annual Meeting of the American Electro-Therapeutic Association.

HELD AT THE ACADEMY OF MEDICINE, OCT. 4, 5 AND 6, 1892.

The American Electro-Therapeutic Association opened its doors October 4, at 10 A. M., with a large attendance of members and a still larger attendance of the profession. The president called the meeting to order promptly at the hour and the business of the day began. The connections were all made and the button pushed. The current traveled at its rate of speed for the ensuing time, which lasted three days. Many hundreds of our profession visited the exhibition during the day, and as many listened to the brilliant and original papers read and discussed by its members. The papers all showed careful research and preparation. The lecture was crowded to the doors. Many of the most prominent of doctors and surgeons where seen at the exhibit and meeting, as Dr. Heitzmann, Dr. Waterman, Dr. Gray, Lieut. G. Bettini, Dr. Brown, Dr. Northrop, Dr. Peterson, Dr. Einhorn, Dr. Goodwille, etc. The reception given to the members by the Association was a social, as well as a scientific, success. The visit to the Edison laboratory was the feature of the entire gathering. A lunch was served in the library of Mr. Edison. Also the special demonstration of the use of the phonograph was given in the Edison lecture room.

Titles of Papers Read at the Sessions.

1. The Use and Abuse of Electricity in Medicine. By Dr. A. D. Rockwell, of New York.
2. The Role and Range of Electricity in Therapeutics. By Dr. Thomas W. Poole, of Lindsay, Ontario.
3. New Contributions of the Electrical Treatment (both Faradic and Galvanic) to the Diagnosis in Gynæcology. By Dr. G. Apostoli.
4. A New Treatment of Prostatic Hypertrophy. By Dr. G. Betton Massey, of Philadelphia, Pa.
5. Electric Cataphoresis and Its Practical Application as a Therapeutic Measure.
   (a) Opening of Discussion. By Dr. Frederick Peterson, of New York.
   (b) The Physics of Cataphoresis. By A. E. Kennelly, Esq., Chief Electrician of the Edison Laboratory, and Prof. E. J. Houston, of Philadelphia.
   (c) Its uses in General Medicine. By Dr. W. J. Morton, of New York.
   (d) Its Uses in General Surgery. By W. H. Walling, of Philadelphia.
   (e) Its Uses in Gynæcology. By Dr. Augustin H. Goelet, of New York.
   (f) Its Uses in Skin Diseases. By ——— ———
   (g) Its Uses in Nervous Diseases. By Dr. Frederick Peterson, of New York.
6. Stabile Electrodes. Old Materials newly arranged. By Dr. R. J. Nunn, of Savannah, Ga.
7. The Value of Voltaic Alternatives in Optic Nerve Atrophy. By Dr. C. Eugene Riggs, of St. Paul, Minn.

The lecture on "The Phonograph and Microphonograph," with illustrations, will be given by Dr. J. Mount Bleyer.

(This lecture was profusely illustrated by diagrams, photographs, etc. The Bethin micro-phonograph was demonstrated by its inventor, Lieut. G. Bethin.)

8. The Present Status of Electrolysis in the Treatment of Strictures. By Dr. Robert Newman, of New York.
9. Some Phases of Neurasthenia and Their Treatment. By Dr. W. F. Robinson, of Albany, N. Y.
10. Some Forms of Rheumatism and Their Treatment By Dr. F. von Raitz, of New York.
11. Rotary Transformers for Medical Use. By Dr. R. L. Watkins, of New York.
12. A Contribution to the Electrical Treatment of Cystic Goitre and Hydrocle. Also a Note on Psoriasis. By Dr. Charles R. Dickson, of Toronto, Canada.
13. The Need of Greater Simplicity and Uniformity in Electro-Therapeutic Apparatus. By Dr. W. J. Herdman, of Ann Arbor, Mich.
14. Medical Electricity from an Electrician's Standpoint. By John J. Carty, Esq., Vice-President of the New York Electrical Society.
15. Anæsthetical Electricity. By Dr. Wm. F. Hutchinson, of Providence, R. I.
16. Some Physiological Experiments with Magnetism at the Edison Laboratory. By Dr. Frederick Peterson, of New York, and A. E. Kennelly, Esq., of the Edison Laboratory.
17. The Effect of Electrolytic Action in the removal of Certain Neoplasms. By Dr. D. S. Campbell, of Detroit, Mich.
22. Memorial.—The late Dr. Gilman Kimball. By Dr. Ephraim Cutter, of New York.
23. Recent Experiences in the Treatment of Myomas. By Dr. G. Betton Massey, of Philadelphia.
24. Electro-Therapeutics and the Systematic Treatment of Morbid Growths. By Dr. John A. Cutter, of New York.
25. Lacerations of the Cervix Uteri and their Treatment. By Dr. F. von Raitz, of New York.
26. The Constant Current in Glaucoma and Cataract. By Dr. S. T. Anderson, of Bloomington, Ill.
27. Note upon a New Application of Alternative Sinusoidal Currents in Gynæcology. By Dr. G. Apostoli.
28. The Electrical Treatment of the Paralysis due to Acute Poliomyelitis. By Dr. Graeme M. Hammond.
29. How to Make Dimples with Electricity. By Dr. Ernest Wende, of Buffalo, N. Y.
30. Anatomical Regression of Intra-Mural Fibroids under Galvanism. By Dr. Margret A. Cleaves, of New York.

The Exhibition of Electrical Batteries and Instruments.

This was the first actual exhibit of that exclusive description that was ever held. The American Electro-Therapeutic Association deserves much credit, and the admiration of the profession, in bringing about this issue. The attendance was large daily and the exhibitors kept busy demonstrating their articles. In looking around the exhibition hall the first stand that comes to our notice is that of Edison-Lalande exhibit Their battery cells for motor, galvanic and faradic use take the first rank in medico-electro appliances. One charging in these cells will last several years with a minimum of cost. Always ready for use. Their cautery cells are the only ones in the market that receive such a high commendation of the profession. Those specialists who put them through severe trials say, "That they are thus far the only thing that does the trick."

As we pass by the next stand—an elite one—we see J. C. Vetter & Company, of New York, exhibiting their standard medical batteries, which have stood the test of the profession for four years. Their batteries require no preparations, no acids, no liquids, but are always ready for use. They are reliable and powerful, possessing great recuperative power (lasting from two to four years when used and do not deteriorate when not in use). Their portable galvanic batteries with milliammeter, rheostat and accessories are ingeniously constructed to fully meet the wants of the medical profession. These apparatus have the endorsement of the prominent physicians and institutions. Amongst their exhibit we find their dry Leclanché, galvanic and faradic batteries, also the dry cells and the well known Vetter current controller.

The next exhibit that absorbed much attention of electro-therapeutists, was that of the Ozone Manufacturing Company. The ozone apparatus is a gem of perfection. We give a modest description of it here:

Ozone apparatus, consisting of motor for production of electricity in connection with a blower for forming the air to be ozonized through the ozone tubes. The air is first passed through a drying tube to deprive it of all moisture. It then passes into a battery of ozone tubes, each tube consisting of two concentric glass tubes, the inner one being filled with water in connection with one electrode. The battery of tubes is placed in a glass vessel also containing water, in which dips the other electrode. The silent discharge of electricity traversing the space between the two concentric tubes. The ozonized air passing from the blower to the outlet of the apparatus. The entire arrangement consists of motor, resistance coil, blower, specially wound transformer, ozone tubes, etc., the whole of which may be placed in a very small space. The quantity of ozone is sufficiently great to fill a large room in a very short time.

The apparatus exhibited is similar to that of which several are in use at the works of the company for the purpose of preparing these products—aquzon, therapol, ærozol, kreozonal and kodozonal—the therapeutic value of which is being recognized by the medical profession.

Following are some of the ozone preparations of the Ozone Manufacturing Company. These have all been recently submitted to the most critical chemical analysis, the report of which is now in the hands of the company. This report gives the following percentages of ozone in the preparations, also by comparison demonstrating the fact that these are the only products in the market that can be shown to contain ozone:

Kodozonol (ozonized cod-liver oil)—A combination of the best Norwegian cod-liver oil, ozone and a small percentage of hypophosphites, the ozone being present to the extent of about 6 vol. per cent. The ozone purifies the oil, makes it palatable and easy of assimilation.

Aquzon (ozonized water)—Ozone being present to the extent of 2.5 vol. per cent.

Therapol—A combination of sweet oil and 8.75 vol. per cent. of ozone. An antiseptic application for all inflamed surfaces.

Aerozol—A combination of essential oils and 25 vol. per cent. of ozone. An agreeable disinfectant which gives off a large quantity of free ozone.

Ozonized Oil of Tar—A solution of ozone in oil of tar.

The W. F. Ford Surgical Instrument Company, of 315 Fifth avenue, make a specialty in the use of storage batteries and all kinds of mechanical attachments therewith. Their show consists of all sizes of storage batteries and many ingenious contrivances which the physician may use in surgical and medical electricity. They also make a specialty of an adapter for the use of the street current, for galvanic faradic current, and also a motor dynamo for cautery current, new concave electric light for general surgical work, a new aluminum head lamp for ear and throat work, small electric lamps for translumination of frontal series, antrum of hymore and post hares, Dr. Einhorn's gastro-diaphane for lighting the stomach, motor outfits for nasal surgical work, including nasal saws, etc.

A very ingenious instrument is shown, devised by Dr. Girdner, for locating bullets with the use of the telephonic ear-piece. Electrical devices to order a specialty.

The exhibit of the McIntosh Battery & Optical Company, of Chicago, in charge of their chemist, C. S. Neiswanger, Ph.G., deserves especial mention as being the largest and most complete exhibit at the meeting, occupying the entire annex. The enterprise of this firm in coming nearly 1,000 miles to show their competitors and some of the best electrical experts in the world the character of the goods they manufacture cannot be but favorably commented upon.

This corporation claims to be, and undoubtedly is, the largest in the world making a specialty of electro therapeutical apparatus, employing nearly 100 workmen, many of whom are expert electricians. Besides the many and well-tried old apparatus and electrodes, they exhibited the latest improved Töpler-Holtz Franklinic machine (said to be the least sensitive to atmospheric influence of any similar machine), new static vaginal electrode, new urethral and cataphoric electrodes, Tripier induction apparatus, rheotomes, rheostats, etc. The accessories on some of the cabinets exhibited by this house excel in beauty of finish and workmanship anything ever seen here before.

GIRDNER'S ELECTRIC PROBE.

The Galvano-Faradic Company, of New York, which is one of the oldest established companies, had a magnificent display of their batteries. They are, in fact, the pioneers in the business, and are known throughout the United States for their first-class workmanship and durability of their apparatus, etc.

The Law Battery Company demonstrated their water rheostat and batteries.

There were other important and interesting features connected with the exhibition.

The Rise of Electro-Therapeusis.

All progress, it may be said, has from time to time been impeded by unworthy work, and the progress of science has suffered as much as that of any other branch of learning, and this not always in its applications, but even in research itself. Astronomy, which has been deservedly called the noblest of the sciences, lapsed through astrology into the most impudent charlatanry, which survives to this day in the silliest form in certain weekly journals. The whole of chemistry was at one period swamped by a flood of delusion, that remarkable quest of the alchemists, which saw a large band of workers whom we must call scientific men, numbering, perhaps, Sir Isaac Newton among them, concentrating all their powers, in their own fashion, upon the direct production of gold; the aim which, although it may be said to underlie all commercial activity, science in its best moments is proud to disclaim. Mechanical science has its Keely motors and Merchant engines; and worthless water motors are being pushed to-day, whether in ignorance or something worse we cannot tell. Electrical science may be justly ashamed of what has been done and what will probably continue to be done with primary batteries for electric lighting, while to many medical men the very name of electricity is abhorrent. Not only is electric light supposed to injure eyesight and telegrams to add to the worries of life, but by electricity presumptious laymen have dared to attempt cures, and in their unrecognized methods have even repudiated either assistance or sympathy from qualified practitioners. The general public are little aware of the debt which they owe to the professional rules and etiquette which control the doctor, the architect, the barrister and other professional men. Their rules, self-imposed and observed, not indeed to the letter, for they are unwritten, but kept with most conscientious strictness, are the safest protection both of themselves and of their clients.

Two hundred years ago electricity was first employed in medicine, and though quackery was rampant then as now, electrical treatment, being unknown, was at least free from reproach. Medical methods have been, and still are, largely empirical, and the remarkable effect of electrical discharges upon both nerve and muscle suggested that some curative properties might be expected from an agent which exhibited such powerful physiological effects. But no rational or systematic use was made of it. Some accidental cures seem to have been effected, and the very ignorance of those who employed electricity encouraged quacks to seize upon electrical treatment as possessing the valuable qualities of mystery and comparative harmlessness. A few workers on the continent had sufficient courage to investigate a branch of medical science which had fallen into disrepute, and about 40 years ago Du Bois Reymond and one or two other physiologists made real advance in purely scientific investigation, while Erb and others studied the use of electricity in diagnosis and curative effects. In this country medical electricity still remained under a cloud. With the exception of the late Dr. Steavenson and Dr. Stone, hardly a single doctor in this country dared ignore the taboo which had been placed upon it by the English medical school.

Erring, perhaps, on the safe side, and with as strong a conservatism as that which forbade them to use certain drugs merely because homœopathists set a high value upon them, they have left it severely alone. One or two makers of induction coils, being unqualified men, have done something to strengthen this prejudice, especially as they claimed success, and during the last few years an honest attempt to apply electrical treatment with care and intelligence has retarded rather than assisted the progress of the subject, because several professional rules were broken, the requirements of proper qualification were not attended to, and advertising was employed, not only directly, but by the equally unprofessional action of communicating articles and papers to non-medical journals and scientific societies. So sensitive are English medical men in this matter that we shrink from devoting much attention to electro-therapeutics in these columns. The discussion of the curative properties of a new drug would be out of place in a chemical journal, though an account of its preparation might not; and we believe that the true interests of medical electricity will be best served if we confine ourselves to any matters of electro-physiology that may arise, to description of appliances, and to the review of books which are sent us. Meanwhile, we believe that steady progress is being made on strictly professional lines both in hospital practice and in private treatment. All that is done in this way goes to the stock of orthodox medical science. Cases of positive cure will be received with caution and new hypotheses with hesitation, and the present prejudice and apathy will doubtless continue well into the next century, but there are ample grounds for believing that in proper hands there is a great future for the use of electricity both for diagnosis and for cure.—*London Electrician.*

Reception at the Electric Club.

A very enjoyable reception at the Electric Club occurred Tuesday evening of last week on the occasion of the annual convention of the American Electro-Therapeutic Association. The doctors arrived about 10.30 P. M., having first held a meeting at the Academy of Medicine, and were met by the members of the Club and enjoyed a very pleasant visit. A well served lunch was discussed and the Club's famous punch bowl was very much in evidence.

Members of the Club present were Gen. E. S. Greeley, E. A. Leslie, Geo. M. Phelps, R. B. Corey, Geo. F. Porter, Chas. W. Price, F. Z. Maguire, T. C. Martin, H. B. Cram, of Boston, H. D. Stanley, and 50 or more others.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 3329. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITORS:
STEPHEN L. COLES.
ROBERT H. READ.

REGISTERED CABLE ADDRESS:
ELECTVIEW," NEW YORK.

"1546 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:
MERWIN J. BULKLEY, 435 "The Rookery."

EUROPEAN OFFICE:
JOSEPH FFRENCH, Editor for Europe.

HOTEL VICTORIA,
Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London
Telegraphic Address: Ffrench, "Victoriola," London.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

PATENT BUREAU,
ROBT. H. READ, Manager.

Patents procured in United States and all foreign countries. Searches, Investigations and Reports on Validity and Infringement.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, OCT. 15, 1892.

CONTENTS.

	PAGE.
Views, News and Interviews	85
The Carstarphen Reciprocating Electric Tool for Sculptors	85
The Edison Decision	85
Electric Railway and Power Notes	86
The Future of Electrical Power Transmission	87
A Method for Recording the Dates of Inventions	88
Personal	88
Interested in Electric Traction	88
The Iona Safety Pendant Burner	88
New Use for Aluminium	88
The New York Edison Illuminating Company and the Board of Fire Underwriters	88
The Westinghouse Company Must Pay Taxes on Its Tangible Property in Pennsylvania	88
Medical Electricity	89
The Rise of Electro-Therapeusis	89
Reception at the Electric Club	89
It is Edison's Lamp	90
Electrical Gleanings	90
Letters From a Laboratory	91
The Standard Electrical Journal	91
Our Chicago Letter	91
The Strong Vertical Triple-Expansion Engine	92
Electric Light Flashes	93
Literary	93
Electric Lights on a Coral Reef	94
Whipple Held in $3,000	94
Advance Information	95
Kindred Interests	96
W. R. Brixey, Manufacturer of Kerite Insulated Wires and Cables	96
Electrical Patents	xii

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
American Electrical Works	i
Ansonia Brass & Copper Co.	xx
Armington & Sims	xx
Babcock & Wilcox Co.	xx
Beacon Vacuum Pump Co	i
Bogert, A. L.	i
Brush Electric Co.	xix
Bryant Electric Co	i
"C. & C." Electric Motor Co.	xv
Crocker-Wheeler Motor Co.	i
Dixon Crucible Co.	xx
Eastern Electric Cable Co.	xx
Eddy Electric Mfg. Co.	i
Germania Electric Co.	xx
Hampson & Co., E. P.	xx
Jewell Belting Co.	xx
Link Belt Engineering Co.	i
Moore, Alfred F.	xx
Noye Mfg. Co., John T.	xx
Okonite Co.	i, ii & xix
Otis Bros. & Co.	xx
Perkins Electric Lamp Co.	i
Schuyler Electric Co.	xix
Simplex Electrical Co.	i
Star Electrix Co.	i
Waldo & Stout	i
Waterhouse Bros.	i
Weston Engine Co.	i
Wilmot & Hobbs Mfg. Co.	xx

INSIDE PAGES.

Allis & Co., Edward P.	xiii
American Bell Telephone Co.	xv
American Engine Co.	xii
Baker & Co.	96
Ball Engine Co	ix & xii
Barnes Co., W. F. & John	xiii
Barrett, John A.	xii
Benedict & Burnham Mfg. Co.	iii
Bernstein Electric Co.	x
Bickford & Francis Belting Co	xi
Bishop Gutta Percha Co.	xi
Blaisdell & Co.	xiii
Brill Co., J. G.	viii
Buckeye Engine Co.	vi
Burton Electric Co	iv
Carpenter Enamel Rheostat Co.	iii
Central Electric Co	iv
Chandler, Ffrench & Co.	96
Church & Sleight	96
Conover Mfg. Co	xviii
Cowles Electric Smelting and Aluminum Co	xv
Cutter, George	x
Davis, Chas. H.	xii
Day's Kerite	x
Detroit Electrical Works	x
Dewey Electric Heating Co.	xvi
Dwight Slate Machine Co.	xiii
Edison Mfg. Co.	viii
Electric Construction and Supply Co.	iii
Electrical Mfg. Co.	xiv
Electric Secret Service Co.	xviii
Elektron Mfg. Co.	x
Electro-Light Engraving Co.	xv
Empire China Works	vi
Enterprise Electric Co.	xi
Eureka Tempered Copper Co.	xi
Faraday Carbon Co.	iv
Falls Rivet & Machine Co.	xiii
Fitzgerald, S. G.	xii
Garvin Machine Co.	xiii
General Electric Co.	ix
Greeley & Co., The E. S.	xii & viii
Harrisburg Foundry & Machine Works	xv
Heisler Electric Co.	xiv
Holman Electrical Co., F.	xv
Holmes, Booth & Haydens	xvi
Horn & Co., G. F.	96
Hulbert Fence & Wire Co.	96
Independent Bung Co.	xv
Interior Conduit and Insulation Co.	xi
Johns Mfg. Co., H. W.	xv
Kellogg Iron Works	xvii
Klipstein, A.	iv
Leclanche Battery Co.	xi
Lehigh Valley Creosoting Co.	xi
MacKie, Robb	96
Marshall, Wm.	iv
Merchant & Co.	iv
Morrison, Geo. H.	96
National Electric Mfg. Co	xiv
National Pipe Bending Co.	xi
New England Butt Co.	xviii
New York Belting and Packing Co	iv
Onondaga Dynamo Co.	vi
Ostrander & Co., W. R.	xv
Penn Life Co.	xii
Pennsylvania Electric Engineering Co.	xi
Phœnix Glass Co	iv
Phosphor Bronze Smelting Co.	xii
Pope Mfg. Co.	xii
Prentiss Tool & Supply Co.	96
Queen & Co.	96
Reed & Co., F. E.	xiii
Railway Equipment Co.	xviii
Rhode Island Tool Co.	xviii
Ries Electric Specialty Co.	xvi
Ridlon & Co., Frank	96
Rosenbaum, Wm. A.	xii
Royce & Marean	xv
Russell & Co	xiii
Sawyer-Man Electric Co.	iv
Sessions Foundry Co.	xiii
Shawmut Fuse Wire Co.	xiii
Shipman Engine Co.	xi
Siemens & Halske Co	vi
Solar Carbon & Mfg. Co.	xviii
Standard Paint Co.	96
Stevens & Morris	xviii
Stocking, E. B.	xii
Swan & Lane	x ii
Transport	viii
Tyndall, Wm. D.	xii
Waddell-Entz Electric Co.	xv
Waite & Bartlett	xiv
Walworth Mfg. Co.	iii
Washburn & Moen Mfg. Co.	xii
Watson & Stillman	xiii
Western Electric Co.	xvi
Westinghouse Electric & Mfg. Co.	v & vi
Wheeler Condenser & Eng. Co.	xvi
Willard & Co., C. P	96
Willson, H. B.	xii
Wood, John, Jr.	viii

We reproduce in this issue leading editorials from two recent numbers of London *Industries* on "The Future of Electrical Power Transmission." The view taken is naturally and distinctly British and not over-sanguine, yet our contemporary admits many advantages possible to accrue from a wider use of electric power, while what it seems to condemn are rather the ideas of an enthusiast than those of a practical electrical engineer. Enthusiasts are, as a rule, in the minority and do not represent a common average of anything. Conditions of progress and development in England are very different from those existing in the United States, and our contemporary seems to realize this when writing of electric railways. There is nothing gloomy about the future of electrical power transmission. We Americans can always fall back with safety on the law of supply and demand. There is no doubt about the demand in this case, and we have our native faith in our ability to furnish the supply.

IT IS EDISON'S LAMP.

The controversy over the fundamental patent for the incandescent lamp is finally settled. In a supplement to the ELECTRICAL REVIEW, for last week, was given a digest of the decision of the United States Circuit Court of Appeals, sustaining the Edison claim to a filament of carbon mounted in an all glass vacuous globe. The second claim, which was the bone of contention on account of the alleged vagueness of the term "filament," was thus paraphrased by the court: "The combination of carbon filamentary or thread-like in size and properly carbonized, used as an illuminant in an incandescent electric lamp, with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air has been exhausted to such an extent that disintegration of the carbon, due to the air, wasting action of surrounding gases, or to any other cause, is so far reduced as to leave the carbon practically stable." This construction is sufficiently broad to include all forms of incandescent lamps now on the market, and puts in the hands of Mr. Edison's assignees a monopoly of the entire lamp industry.

Thus after many years the inventor is placed in full possession of his own creation, for to Mr. Edison more than any other undoubtedly belongs the honor of creating the industry of incandescent electric lighting. It is unfortunate that the legal processes of sustaining or defeating a patent are so slow. The contest just concluded has been fought for seven years, during which rival companies have invested heavily in incandescence lighting, believing, with what Judge Wallace thought was good warrant, that the patent was too uncertain in meaning to be given the scope claimed for it by its friends. Unhappily, the same charge might be laid with more or less force at the door of every broad patent. The draughtsman of a claim is confronted by two difficulties. If he makes it too broad, the patent is void; if too narrow, the patent is worthless. In either case, his client's rights are forfeited. Confronted by Scylla on one side and Charybdis on the other, he steers between as best he can. It is utterly impossible for the human mind to anticipate all ramified by-ways of future infringers. This predicament accounts for much of the alleged vagueness of patent claims. It is simply a selection of terms of definition sufficiently elastic to bear a little shaping at the hands of the court. The word "filament" has proven to be a term of this character. In the light of Mr. Edison's great contributions as a pioneer of the art, it might be said those who ignored his patent did so wilfully—his equities in the case were strong; but on the other hand the prior state of the art had shown burners of various degrees of thickness—some of which might have been logically described as filaments, thus throwing a cloud over the patent which rendered its ultimate triumph doubtful, There is a cure for these difficulties; if the fate of a patent could be definitely settled in a year—and it ought to be—all business dependent upon patents would be put upon a firm basis, invention would be stimulated by the promise of quick reward, the courts would be relieved, the infringer could apply his energy in more useful work, and increased prosperity would result all around.

So far as the general public is concerned, the decision will doubtless not be felt. The light will be just as cheap and just as good. Whether the rival types of lamps will be made at an Edison factory or licenses will be given to the several makers remains to be seen. The Edison Company or its assignees will pocket some dividends and those who, believing the patent worthless, went into the lamp business, will resign themselves to the situation. In about four years, at most, the patent will expire and the making of lamps, so far as this patent is concerned, will be public property.

Electric illumination is strongly in evidence in this city this great Columbus week. Many of the most happy and brilliant effects were produced by means of the storage battery and incandescent lamp.

ELECTRICAL GLEANINGS.

ABSTRACT OF A LECTURE DELIVERED BEFORE THE GERMAN TECHNICAL SOCIETY OF BOSTON, OCTOBER 6, 1892, BY PROF. W. W. JACQUES.

Electricity as a science dates back for centuries. Electricity as an art has been developed within the memory of men still living. The study of electricity as a science, that is, the study of electric phenomena and laws for their own sake, independent of the uses to which they may be put, began when Stephen Gray, nearly 200 years ago, divided bodies into conductors and non-conductors, and thus made the conception of an electric current possible.

For 150 years after that investigators in the field of electrical science, working largely in the laboratories of the grand old German universities, were busy finding out how electricity might be produced, what were its laws of action, how it could be measured and what it was capable of doing. Thus was the *science* of electricity built up.

One evening, not many weeks ago, I was invited to witness some experiments in sending photographs over a wire by means of electricity. You may imagine that I went with a good deal of interest to the laboratory of my friend. The laboratory consisted of two rooms. In one was an ordinary photographic camera, a small developing closet, and on a table in the middle of the room a cubical box, in one side of which was a slit of sufficient size to receive a postal card.

From this box two wires stretched across the room to the partition wall, and, passing through this, extended to a similar cubical box standing on a table in the middle of the adjoining room.

I was given an ordinary postal card and asked to write a short note upon it, and wrote "Good morning; how do you do?" My friend then took the card and placed it about six inches in front of the camera, where it was well illuminated by an electric lamp. Then he pressed the button of the camera, then took the plate-holder to the developing closet, and presently reappeared with a hastily made negative, which he dropped into the slit in the cubical box on the table in the middle of the room. I then went into the adjoining room and there, issuing from the corresponding box on the table in the middle of the room, was a piece of thin paper the size of a postal card, on which appeared in *fac-simile* the words I had written, "Good morning; how do you do?" There would seem to be no reason why the sending and receiving boxes, instead of being in adjoining rooms, should not be placed one at one end of the wires in Boston and the other at the other end in New York; and thus letters written in one city could be instantaneously photographed to the other, and beat the United States mail by six or seven hours.

Another experiment, in which I have taken part only this last week, was to sit in my office in Boston and talk by long distance telephone with friends in Chicago, more than a thousand miles away. And this, too, as easily as if my friends had been sitting with me in the same room.

During the Centennial Exhibition in Philadelphia, Professor Bell exhibited his then undeveloped telephone, which, though it whispered only feebly and imperfectly, was declared by Sir Wm. Thomson to be "The greatest marvel hitherto achieved by the electric telegraph."

At the Columbian Exhibition, soon to be held in Chicago, we shall see that invention grown so big that it will talk loudly and clearly between that city and New York.

Another invention that must soon come—an invention whose underlying principles have been already worked out—an invention that is only waiting for some ingenious inventor to make, is a good method of electrical signaling between two vessels approaching each other in the midst of a thick fog at sea.

Let us imagine such a device applied to two ocean greyhounds approaching each other with a combined velocity of 40 miles

an hour through a heavy fog in a dark night. The lights are useless, for even an electric search-light will not be visible a mile away. The steamer's whistle is useless, for the fog soon absorbs the sound; and yet these two vessels may be rushing immediately towards each other with a force and velocity that, in case they meet, shall mean total annihilation.

And yet there is no need of such danger. Means of producing electrical signals on the one vessel already exist. The ocean is an excellent medium for conducting these signals to another vessel many miles away, and means, on the second vessel, for detecting and recognizing such signals may easily be contrived.

Let us see how electricity steps in and points out a simple way by which such collisions may be avoided.

Suppose each vessel to be equipped with an insulated wire running from bow to stern, but dipping into the ocean at each end. Suppose one vessel to have included in this wire means for producing strong and rapidly alternating currents of electricity. Suppose the second vessel to have connected to its wire an ordinary listening telephone.

Electrical undulations will be radiated from the first vessel through the water in all directions until, reaching the second vessel many miles away, they will be heard in the listening telephone.

By equipping each vessel both with means for sending out electrical undulations and for listening for any that might be received, each vessel would be made aware of the approach of the other and the danger of collision avoided.

But the greatest electrical harvest to be gleaned in the near future will come when some inventor or engineer devises a method of converting the energy stored up in coal directly into electrical energy.

At present we burn coal under a boiler and produce steam; then we pass the steam through an engine and produce power; then the power of the engine turns a dynamo and produces electricity. We thus have a long chain of expensive machinery, at each link of which there is so great a loss that, of 100 pounds of coal burned under a boiler, only about five pounds appear as electricity, a clear waste of 95 per cent.

Some day there will devised an electric generator, in which coal is shoveled in at the bottom and electricity taken out at the top, thus using only one piece of mechanism instead of the whole chain used at present, and thus possibly converting the energy of the coal into electrical energy without this enormous waste.

It is thus theoretically possible to get 20 times as much electricity out of a ton of coal, and consequently 20 times as much power as we do now.

Let us see some of the results that would follow.

A transatlantic steamship that now burns 300 tons of coal per day would then burn but 15; or, with the present coal consumption, she would be able to cross the ocean in less than two days.

An electric locomotive, carrying its own supply of coal and generating its own electricity, would be able to haul a train of cars from Boston to New York in less than two hours.

The machinery of our great manufactories, which now requires to move it work equivalent to that which could be done by 2,000,000 men, could then be operated for one-twentieth of the present cost.

In order to get an idea of the value of such an invention, let us see what the steam engine has done for us, and then imagine what an invention 20 times as efficient could do.

"Some time before his death in 1819, while resting from labor in his old age, James Watt, the inventor of the steam engine, when asked to allow his fellow citizens to honor him with a seat in Parliament, refused, saying that he had given employment to the better part of a million of men, and had earned the right to rest from work. To how many millions of men since then has his invention given employment?" How immensely has the working power of our people been increased, and how enormously have the comforts and luxuries of life been multiplied by the aid of the steam engine.

The steam engines of the world to-day are doing work that, to be accomplished without them, would require 1,000,000,000 of men.

In Massachusetts alone there are to-day on our railways 2,000 locomotives doing work equivalent to that of 2,000,000 horses, or 40,000,000 men. In our factories are steam engines engaged in spinning and weaving and forging, and great marine engines moving our commerce, that do the work of many millions more.

I have estimated that were the 60,000,000 people in our country all slave holders, and all the rest of the world their slaves, each could not have, without the steam engine, the comforts and luxuries he has to-day.

Attempt, now, to conceive the benefits of an invention 20 times as efficient as this, and the figures become such that the imagination staggers under their weight.

LETTERS FROM A LABORATORY.—XVI.

BY JULIAN A. MOSES.

The recent wonderful records made by the bicyclist, Zimmerman, and the queen of trotters, Nancy Hanks, have set the public thinking. The various questions that have arisen throwing a shade of doubt on these performances have made practical experimenters imagine that while the means employed may be all that are required to assure the general public of their honesty of purpose, the one thing needful to ensure accuracy has not been obtained, viz., a correct means of recording the time in which these astonishing performances have been made. It may be said that there are three or more judges of time, or timers, as they are called, and that while one, or even two, may make a mistake, the averaging of the three will be sufficient to correct all errors and make the records unalterable, provided the men are well known and well tried timers. The fallacy of this argument is that there is a chance of all three timers being incorrect and erring on the same side, which would increase or diminish the time of the record, as the case may be. If this question is one of such importance as it has lately grown to be, let us have some means of obtaining accurate records by which we can stand and feel assured that they are the true results of a well merited effort, and not merely a few numbers written coincident with some apparently great performance.

The means now employed for starting are not such as to avoid all chances of error in the recording of the time. It is impossible for a person to think and act simultaneously and if it is impossible to obtain the correct time of the starting, it naturally follows that all observations afterwards are incorrect and useless. Why is it that we accept these records as *bona fide*, and not try to determine whether they are really what they are represented to be? The answer to this may be, that what the judges of athletics and racing are satisfied with, the public should be also. This may be the reason, but I am inclined to think that these records can be moulded to suit the fancy of the few, while the many are forced to look on in silent and unanswerable admiration. We now have no way to disprove their statements, and what they say we must accept as true.

I offer a remedy for this mild evil and and hope that it will correct it.

Time has been recorded by mechanical means ever since the year 130, B. C., when the Greeks and Romans used the clepsydra for measuring time by means of dropping water. Various stages of development have been gone through until we have reached the so-called electrical clock, or, more properly speaking, the electrical dial, governed by some standard clock, which can regulate any number of dials at different places. Recording clocks have also been made which mark on paper, by some mechanical or chemical means, the regular passage of some electrically controlled device, such as are generally used in conjunction with recording thermometers.

The apparatus that I have in mind for the correct recording of races is extremely simple and inexpensive. The recorder itself consists of a dial which revolves at a regular rate of speed, say, once per second. On the outside edge of the dial, which is a brass plate, cogs are cut, which, playing in another cogwheel, in turn cause an indicator to travel radially across the dial, from the circumference to a point about half way between it and the center. The indicator is attached to an arm which is held by a weak spring from dropping on an electro-magnet. Each revolution of the dial is recorded by a numerical indicator, which is placed at the head of the dial, so that each time a pin, which is placed in the edge, comes round to the same place again it will move the indicator one number. The dial is divided into 100 divisions, each of which represents the one-hundredth part of a second.

To the indicator, which is controlled by the electro-magnet, is attached a pencil, which, when the arm is attracted by the electro-magnet, will make a dot on the graduated circular card placed on the dial to receive the record,

On the track, at the starting point of the race, is either a spring plate, which, upon being released, makes an electrical contact; or, instead of this, a slender thread, stretched across the track, which holds a device for making and breaking the circuit when the string is separated, thereby causing the arm of the indicator to be attracted by the electro magnet, thus making a dot on the face of the dial. When the end of the race is reached, another slender thread is broken by the racer and a second mark is made. By simply reading the dial, the fraction of a second may be thus accurately determined, the numerical indicator giving the time in seconds. By means of this device starters, timers and watches may be done away with at the track, and, as regards the results, if the instrument is accurately made, there need be no danger of incorrect records, and in place of those now in existence we will have records upon which we can depend.

It is fortunate for Columbus's hatter that the explorer is not alive to appreciate what a great man he is.

Electrical circles are quite active again. The incandescent lamp decision seems to have stirred things up.

New York does not want the trolley and will not have it.—*Herald.*

New York does want the trolley, and will have it.

The electrical decorations of the city and the electrical features of the Columbus parade will be grand. The companies having the work in charge have been toiling day and night for weeks and the results will be worthy of the labor. A hard worked electrical engineer had time to stop one day last week long enough to ask a friend: "Do you think you will look up or down at the next Columbus parade?"

We think the Columbian night parade in this city, October 12, will prove a great success, and electricity will be a chief factor. A more brilliant effect, we think, could have been secured, however, if, instead of carrying storage batteries in each float, a few portable arc light plants had been installed and connected by insulated wire with the different floats. With different colored globes, a dazzling and beautiful light could have been arranged over each float, and, while the expense would have been slightly increased, the effect would have been most unique and ever to be remembered.

Mayor Grant has signed all the applications of the Metropolitan Traction Company for permission to extend and connect its roads, which were approved by the Board of Aldermen, except the one for permission to extend the Ninth avenue road northward through Columbus avenue. This last is the longest route on which it was intended to use the trolley system. The resolution approving this application will be recalled by the aldermen and will be amended and acted upon at a special meeting of the board, to be held this week. So far, so good. If the people on Ninth avenue decide that they want the trolley, it is safe to say that they will get it.

The Governing Board of the International League of Press Clubs meets in Chicago at the Auditorium Hotel, October 20. The members will also participate in the Columbus festivities of that week. First Vice-President John A. Cockerill, ex-President T. J. Keenan, Jr., Secretary Chas. W. Price, Wm. Berri, Wm. V. Alexander and about a dozen others, with their ladies, leave New York for Chicago on special Wagner cars on the New York Central, Tuesday evening, October 18. General Passenger Agent G. H. Daniels, of the New York Central, and Superintendent J. C. Yager, of the Wagner Company, and their wives, accompany the party. President and Mrs. De Young will meet the Eastern delegates at Chicago.

THE STANDARD ELECTRICAL JOURNAL.

A Great Manufacturing Company's Opinion of the Electrical Review.

TO THE EDITOR OF ELECTRICAL REVIEW:

For several years we have been constant readers and frequently advertising patrons of the REVIEW. We have found its subject matter interesting and always pleasingly displayed.

Now, since the introduction of the "Advance Information Columns," the paper has, in our estimation, an increased value. We can trace some very satisfactory results to these little trade notices, and take this opportunity to make our acknowledgment of their special value to us. As an advertising medium the REVIEW has always been satisfactory. Yours very truly,

Automatic Engine Dept., Russell & Co.,
C. A. GATES, Manager.
Massillon, Ohio, October 1.

OUR CHICAGO LETTER.

Mr. Fred Reckenzaun, who has been in Chicago for some months, returned to New York last Friday.

The McGuire Manufacturing Company, of Chicago, have contracted with the Chicago City Railway Company to furnish them with 61 of their electric trucks.

Clark & Marshall, 413 Rookery Building, Chicago, have secured the General Western Agency for the following specialties: The Boston Incandescent Lamp, manufactured by the Boston Lamp Company, of Boston, Mass.; the Arnold Flexible Bracket, manufactured by the Arnold Novelty Company, of Tacoma, Wash.; Cope Automatic Come-Along, manufactured by T. J. Cope, of Philadelphia; and the Dow Adjustable Incandescent Lamp Hanger. Clark and Marshall have put in a large stock of these specialties so as to meet the increasing demand.

The E. W. Bliss Company (Limited), 17 Adams street, Brooklyn, N. Y., in order to accommodate the steady increase of its business in the West, have opened an office and store at 14 Canal street, Chicago, where they will keep a line of presses, drop hammers, shears and sheet metal machinery. The office will be in charge of M. C. W. Ellsworth, who until recently was superintendent of the Chicago Stamping Company. His long experience with tools of this class will be of great value to himself and to the trade. The store is located in the heart of the machinery district of Chicago.

The National Time Recorder Company, of Milwaukee, Wis., will shortly place on the market a clock device, to be known as the Bolte Automatic Time-Keeper. This device shows the exact time of the arrival and departure of employés. It is so made that the proprietor passing through the door sees at one glance just how many employés were late, and how many minutes, and the employés themselves can also see in plain sight the time their key registers, either at the time of recording or at noon when going to dinner. Mr. James Ilsley, of the Marshal & Ilsley Banking Company, is president of the company, and Mr. F. H. Bolte is the inventor.

The Siemens & Halske Electric Company of America have closed the contract to install a plant in the Auditorium hotel and building. The building has been lighted by an electric system, but this will be thrown out and the Siemens & Halske Company will install a plant of about 17,000 lamps. It was decided to build a power house to the south of the new Congress Hotel (which is to be an addition to the Auditorium) fronting 55 feet on the alley between Michigan avenue and Wabash, and 90 feet deep. In this will be installed a boiler, engines and dynamo plant capable of a maximum output of 1,300 kilowatts, though it has been estimated that the greatest load will never exceed 800 kilowatts. The two buildings will be wired for about 17,000 lamps. There will be five engines in the installation of the compound non-condensing type. One of the engines will be of 800 horse-power, two of 350 horse-power each and two of 150 horse-power each. Each of these will be directly connected to a Siemens & Halske multipolar dynamo. With its 1,800 horse-power and 17,000 lamps, the plant will be the largest private one in the country. M. J. B.

Chicago, October 8.

Holidays, crowds of strangers, bunting, electric lights, fire-works, parades, music, and festivals of all kinds, will probably make a dull week for business men in New York. Brush up your patriotism, look happy, cheer for Columbus, who made you possible, and make it up next week.

The Strong Vertical Triple-Expansion Engine.

The engine shown in the accompanying illustrations has been designed to meet the demand for a compact machine suitable for driving dynamos, and for other purposes where it is desirable to economize space, to secure economy in fuel, and to utilize the higher ranges of expansion, either as a condensing or non condensing engine. There are many places where it is not practicable to use a condenser on account of the scarcity of condensing water, and as it is possible to secure about the same economy with very high steam pressure without condensation, this engine has been designed to fulfill that end. It has been the aim of the designer, Mr. Geo. S. Strong, the well-known mechanical engineer, of this city, to put a triple-expansion engine into the simplest and most compact form, and at the same time to meet all the requirements that are considered necessary for general efficiency and economy.

FIG. 1.—THE STRONG VERTICAL TRIPLE-EXPANSION DIRECT CONNECTED ENGINE.

A peculiarity of the design is that the engine is self-contained and balanced. The reciprocating parts of the two sides have simultaneous opposite movements, the cranks being 180 degrees apart, and thus, in a manner, balancing each other. In consequence of this, and the fact that each side is independently balanced by a counter-weight on the crank, less foundation is required and more quiet running is produced than would otherwise be the case. This is very important in buildings where jarring from engines is very annoying. If it is desired that the engine shall be absolutely noiseless, it can be placed upon a foundation insulated on the bottom by cork from the foundations of the building, while on the sides packing or other material can be used that will not transmit noise or vibrations to the walls.

To meet the requirements of an engine using steam of 180 to 200 pounds pressure, piston valves have been selected for the high and intermediate cylinders and gridiron slide valves for the low pressure cylinders. By this means frictionless valves for the high and intermediate cylinders, where the pressure is high, are secured. In those cylinders the matter of clearance is comparatively unimportant. In the low pressure cylinders, however, small clearances are very necessary for economy, and are brought about by the use of the gridiron valves in the cylinder heads.

The high and intermediate cylinders are double acting, while the low pressure cylinders are single acting with trunk pistons, which act as cross-heads for the engine. The piston rods extending up through from the low pressure cylinders, carry the two pistons, one of the high and the other of the intermediate cylinders. The steam is admitted to the high pressure cylinders by a central piston valve, located in the same valve chamber and between the two piston valves that exhaust the steam from the high pressure cylinder on to the piston of the intermediate cylinder. This first valve admits steam to the high pressure cylinders, and cuts it off according to the requirements of the engine to maintain a uniform speed, but does not exhaust it, the exhaust being controlled by the end valves, as described.

The movement to this central valve is transmitted through the solid valve stem, which works through the hollow valve stem that operates the two end valves. This solid valve stem is worked from the link block, which block is controlled by the governor, while the hollow valve stem that controls the movement of the end valves receives its motion from the pin in the end of the link, and has a constant travel.

The two end valves exhaust the steam from the two ends of the intermediate cylinder into the passages which lead to the gridiron slide valves that admit the steam into the low pressure cylinders, and it is exhausted from the low pressure cylinders through the gridiron valves situated on the outside and in this same casting which forms the heads of the high and intermediate, and also the heads of the low. Thus all the valves are in the one casting that joins the high and intermediate cylinders. This casting is finished entirely by boring, as all the valves are introduced by borings. The valve seats of the gridiron valves are taper plugs with the valve faces milled or planed in them so as to make a plain flat faced valve in a cylindrical seat which can be easily introduced and easily removed, or replaced.

The piston valve of the high pressure cylinder is actuated by a block sliding in the well-known Fink link, so designed as to give a perfectly equal lap and lead, and, at the same time, equal cut-offs at both ends of the cylinder. The position of this block, and, therefore, the cut-off is controlled by a sensitive high-speed governor, the resistance to the movement of which is very slight. The exhaust of the high pressure cylinder and the admission and exhaust of the intermediate cylinder are controlled by a connection to a fixed point at one end of the link. These valves have a fixed travel and point of cut-off. The movements of the low-pressure valves, both inlet and exhaust, are produced by the same connection to the Fink link, and are such that when these are unbalanced they are motionless. All pins and bushings in the valve gear are of hardened steel, thus reducing the wear and rendering replacement easy.

The governor is provided with a safety device, so arranged that in case the governor belt breaks, the arms of the governor will be elevated and the link block thrown to an extreme position, thus cutting off the supply of steam and bringing the engine to a stop.

The crank shaft is forged from a solid steel ingot, and the counter-weight is bolted on. The pedestals are bored and turned on their bases to fit a bored seat in the bed-plate or frame of the engine, to which they are secured by ream bolts. The seats for these pedestals are bored by a single setting of a boring bar, and are consequently in perfect alignment.

This peculiar arrangement of pedestal makes it possible to get at any of the brasses in the bearings without disturbing the armatures or fly-wheels or removing the shaft, as the pedestals, owing to their having a base which is circular in form, the center of which circle is the center of the shaft, can be revolved around the shaft and by loosening up the caps on two bearings, the third one can be uncoupled and the shaft slightly wedged up, and the pedestal in which the brass that is desired to be reached can be unbolted and revolved to the top of the shaft and removed, and the brass replaced or scraped and put back.

The importance of this feature will be appreciated by those having charge of large directly driven dynamos where the dynamo has to be dismantled to get at a brass that is inclined to give trouble, as such an operation means the loss of the use of that particular engine and dynamo for days, as well as the cost of many vexatious hours of labor on it.

The advantages of direct running are so apparent as barely to require comment. In many places the saving to be made in cost of property for a plant of large capacity, is enough to go a long ways toward paying for the engines, and as against the ordinary high speed, or ordinary compound, this engine will effect so large a saving as to make the cost of it over such engines a matter of small consequence. Many of the electric light plants now being driven by the small high speed engines and using the ordinary pressures are using four and five pounds of coal for horse-power developed; while with this engine, with such a boiler as the builders propose furnishing with it, will give the same power with $1\frac{3}{4}$ pounds of coal, or a horse-power for $1\frac{3}{4}$ pounds of coal, and as coal is the one large item in the cost of either light or power plants, the advantages to be gained by the best engine are apparent.

As compared with a station fitted with large slow speed engines, the saving in cost of line shafting and belts will be so great as to make this the cheaper method of the two, besides the saving in oil and wear and tear of belts, and the avoidance of the noise incidental to the use of belts, and the greatly increased floor space required for the line shafts, and necessary length of belt to get the necessary adhesion of the belt.

Where it is not desirable to use direct connection dynamos, the engine with the fly-wheels can be used, and a large dynamo driven with a belt direct from each pulley or fly-wheel; or if a number of dynamos is desired to be driven from each pulley, it can be so arranged, with a wide faced pulley, that a number of belts can run from the same pulley on to as many different dynamos; or if rope driving is preferred, it can be so arranged as to make each fly-wheel a rope wheel and from it divide the power as much as is desired. For stations where line shafting is desired to be used and a number of small dynamos driven from each line shaft, the engine can be coupled direct to the line shaft and the different pulleys worked by friction clutches on the shaft, so that any pulley with its dynamo can be stopped at will, while the line shaft continues to run, and, if desired, there can be two engines, one at either end of the line shaft, coupled by friction or other clutches, so that either engines or both can be at work driving the same dynamos, and either can be stopped without stopping the line shaft.

By this method, one engine can be run when a light load is on, and both engines can be put to work when the full load comes on, thus giving the most economical load and overcoming the difficulty that has been experienced about running compound engines under light load.

Two sizes of this engine are shown in the accompanying illustrations, Fig. 1 being of 150 indicated horse-power, and the other, of which two views are given in Figs. 2 and 3, of 250 indicated horse-power. The first runs at a speed of 300 revolutions per minute and the second at 225. It is the intention of the builders to manufacture these engines in sizes up to 2,500 horse-power.

The engine is manufactured by the Providence Steam Engine Company. The details of the engine have been worked out under the supervision of Mr. F. W. Dean, of Boston, Mass.

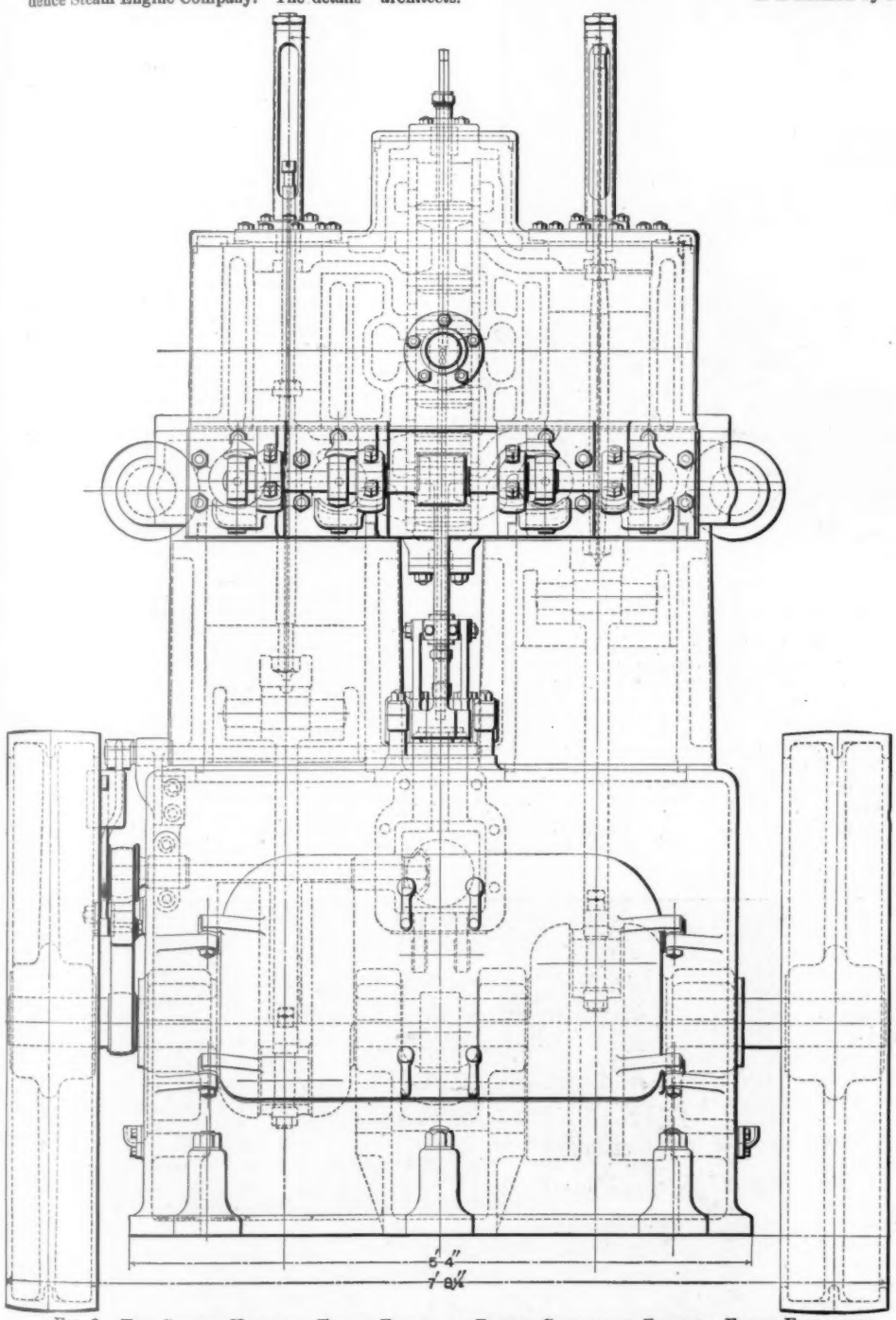


FIG. 2.—THE STRONG VERTICAL TRIPLE-EXPANSION, DIRECT CONNECTED ENGINE.—FRONT ELEVATION.

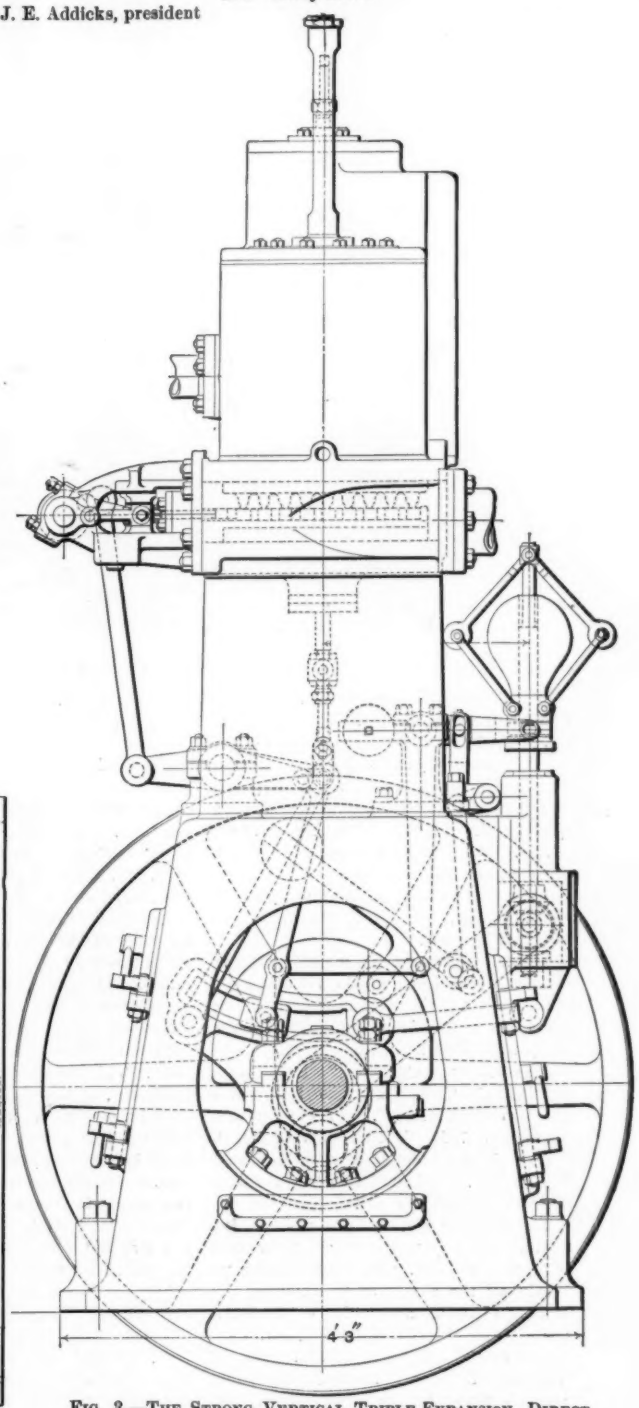


FIG. 3.—THE STRONG VERTICAL TRIPLE-EXPANSION, DIRECT CONNECTED ENGINE.—SIDE ELEVATION.

ELECTRIC LIGHT FLASHES.

A new eight-inch steam fire alarm whistle has been installed at the Pittsfield, Mass., electric light station.

Whitehall, N. Y., has made a five year contract for 21 arc 1,200 candle-power lights and 64 incandescent 25 candle-power lights for $3,700 per year.

A franchise has been granted to the New Richmond Electric Light and Power Company to build and operate a plant at Boardman, Wis. The plant will be in operation by November 20.

Myron H. Peck, Jr., attorney for the Batavia, N. Y., Board of Aldermen, has received the opinion of Judge Daniels on the question of the authority of the village to purchase and operate an electric lighting plant. Judge Daniels is of opinion that the village has such authority under its charter.

Plans have been drawn for the building to be erected for the Chicago Edison Company on the west side of the river, near Harrison street. The cost of the structure will be about $220,000. It will be 200x210 feet, one story high, of brick, etc. There will be boiler, engine and dynamo rooms and office space. Shepley, Rutan & Coolidge are the architects.

The electric light not only flourishes at Kobe, Japan, but the company working it pays dividends. The company held its ordinary general meeting for the first half of this year on July 14. The profit of the period amounted to *yen* 7,669,492, besides *yen* 414,609 brought forward from the previous period. A dividend of 10 per cent. was declared.—*Bangkok Times.*

It looks a little as if the New Britain, Conn., Electric Light Company would be sold out to a party of capitalists who will furnish the capital for the electric tramway. A proposition has been made to the electric light company which is quite favorably received by the stockholders, and it is expected that a meeting of the directors to finally determine the matter will be held on or about October 15.

A Denver paper recently printed the following despatch from the lively mining town of Creede, Colo.: Creede is rejoicing to-night on the resumption of the pioneer electric light plant. The mellow beams of Senator Poole's arc lights are casting a brilliant light over the camp, and the now exclusive phrase that "There is no night in Creede" is for the first time since the fire brought into play. The prosperity of the camp is also again given a substantial backing, for where there is light there is hope.

It is claimed by J. E. Addicks, president of the Bay State and Boston Gas Light Company, that the Suburban Electric Light and Power Company is hopelessly insolvent, and last week he was before Judge Harriman, of the Suffolk County Insolvency Court, asking that it may be adjudged so. He says that the electric light company is his debtor to the amount of $7,786.60 for money advanced it, and that it is unable to pay him. He brought a suit in the superior court against the corporation and attached the property. The Suburban Company denies that it owes Mr. Addicks anything. It contends that the attachment in his suit was unlawful, and that it was a trespass upon its rights. After hearing the testimony of an accountant and W. A. Paine, of the Suburban Company, the case was continued until this week.

LITERARY.

With a page of "Pretty Luncheons and Dainty Teas," a special paper on "Changes in Fashionable Stationery," by Ada Chester Bond, and an article by Mrs. A. G. Lewis on "Children's Parties, Fetes and Frolics," the October *Ladies' Home Journal* opens attractively and well. Marguerite Merington gives a sketch, with portrait, of Margaret Deland, the author of "John Ward, Preacher," and Mrs. Mallon writes entertainingly of the personality and home life of "The Duchess," the author of "Phyllis" and "Molly Bawn."

Mr. F. Hopkinson Smith, who is now in Venice, completed, just before his departure from New York, the text of his book on "American Illustrators," which Charles Scribner's Sons will soon publish in a Japan Edition de Luxe in a few days. The author's plan has been to divide his subjects into groups, and put both his criticisms and descriptions in the form of conversations. The illustrations are of a very exceptional character. Besides nearly 100 text engravings, portraits, sketches, etc., there are 15 large plates, eight of them in color, *facsimiles* of the original drawings. The artists represented in the large plates are Abbey, Reinhart, Homer, Gibson, Remington, Smedley, Metcalf, Low, Cox, Kingsley Pyle, Frost, Zogbaum and Blum. But 1,000 of the Japan edition are printed, and a large proportion of these have already been subscribed for ten days before publication.

Electric Lights on a Coral Reef.

DESCRIPTION OF AN INTERESTING PLANT AT KEY WEST, FLA.

The installation of an electric light plant at Key West, Fla., has attracted considerable attention in electrical circles, from the fact that it is the southernmost plant in the United States, and is built on a coral reef.

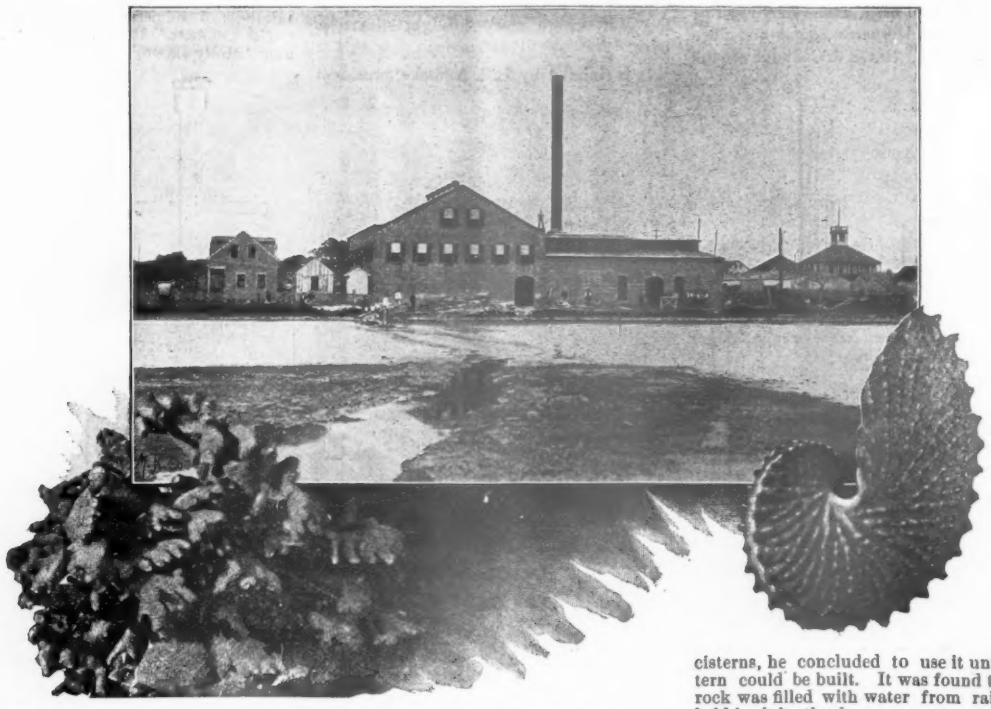


FIG. 1.—EXTERIOR VIEW OF THE ELECTRIC LIGHT STATION AT KEY WEST, FLA.

Key West lies in latitude 24° 32′; a mere speck of rock begirt by the blue waters of the Gulf, almost unknown to the rest of the world, and the very end of the United States. The Key has been settled about 70 years, and during that time has grown from a small hamlet of fishermen to a city of 23,000 people. The inhabitants consist of Cubans, Negroes, Conchs and Americans. The Americans are endeavoring to lift the city out of the old-time rut by improving the condition of things in general.

Through the efforts of the latter class of citizens, the lighting of the town in a civilized manner has been accomplished. Some years ago a franchise was granted and a company formed known as the "Key West Gas and Electric Company," who erected a small gas plant, using petroleum, from which gas was manufactured. This went into operation in 1884. The question of installing an electric plant was brought up from time to time, and in order to hold the franchise a few poles were set.

Through the efforts of Mr. John Jay Philbrick, a local merchant, an extension of time was granted, and, after buying up nearly all the shares of the company and making a careful examination of the different systems of electric lighting, Mr. Philbrick, in the early part of 1891, gave the Thomson-Houston Electric Company, through their Atlanta agent, Mr. Hiram Ogle, an order for the electric plant, and the Ball Engine Company, of Erie, Pa., an order for the steam plant. The lighting plant called for was one 50 light 10 ampere arc dynamo, with lamps of 2,000 candle-power; one 650 light, and one 1,500 light compound wound alternating dynamo, for lamps of 16 candle-power, with all the necessary appliances and fixtures. The steam plant consists of three Ball condensing tandem compound engines of the latest improved pattern, one of 65 horse-power, one of 110 horse-power and one of 165 horse-power, one Otis heater of 300 horse-power, one Wheeler surface condenser of 300 horse-power, one Davidson air pump and fresh water pump, one Korting injector, two steel boilers 150 horse-power each. A brick building 62x45 feet was erected in which to place the machinery. But here the first difficulty presented itself. A pit ten feet deep was required for the heater, condenser and pumps, but this was found impracticable on account of the friable nature of the coral rock, through which the water bubbled up without interruption. It would require a powerful steam pump to keep the pit clear while it was being dug, and costly masonry to keep the water out after it was dug. The rock could only be worked with pick and shovel; blasting had but little effect on account of being very soft and offering no resistance. The plans were changed.

An additional brick building, 80x60 feet, was built, in which the engines and dynamos were placed on foundations 10 feet high, of hard brick, resting on the coral rock, and with a small amount of earth filling, making a solid mass of masonry 36x40 feet and 10 feet high. On the top of this mass of masonry and earth filling was spread grouting of broken stone and cement six inches thick, and finished with a graniteoid floor 1¼ inch thick. This brought the heater, condenser, pumps and hot well on a level with the floor of the first building (which was used for a boiler house) between the engine foundation and partition wall. In front of the condenser a salt well, 18x18 feet and five feet deep, was dug in the rock, from which the water supply for the circulating pump was drawn. From this to a salt water pond, on government land, 100 feet west of the station, a canal was dug through the rock to the pond, which cov ered about three acres and was connected with the sea. The depth of water in the pond was 13 inches at low tide. Spread over the bottom of the pond was 23 inches of silt. A channel 10 feet wide was dredged through the pond and the inlet from the sea deepened. A tide gate placed in the inlet allowed the tide to enter the pond and closed on the ebb, giving a depth of about 25 inches of water at low tide, an ample supply for condensing purposes. The top of the boiler house floor was but 23 inches above the high water mark located on the beach. While digging the salt water well the water ebbed and flowed with the tide, although over 100 feet of rock lay between the well and pond which was affected by the tide. The distance from the station to the sea proper was 1,100 feet.

There is no fresh water on the island, except what is collected from the roofs, stored in stone cisterns and sold at one and a half cents per gallon. As no cistern had been built for the use of the station, and it was necessary to have enough fresh water to make up for the waste and fill the boilers after cleaning, the engineer made an examination of the brackish water which could be drawn from the rock at a depth of from three to five feet, and as this water was used for domestic purposes by those who had no cisterns, he concluded to use it until a cistern could be built. It was found that the rock was filled with water from rains and held back by the dense sea water surrounding the island, and at a level somewhat above the tide marks, ebbing and flowing with the tide. A well four inches in diameter was drilled into the rock and the water tested for salt every foot. At a depth of 20 feet a slight change was noted and the drill stopped. A pipe 18 feet long was dropped in for suction and the boilers fed from this when occasion required. A trace of salt was perceptible in the water, but on the whole it was superior to water used at many places on the main land for boilers. In a trial of two hours' duration, the pump delivered a solid stream through a one and a quarter inch nozzle without diminishing the supply, showing conclusively that the water flowed through the rock as readily as through gravel. Although a small quantity of this water was used for boiler fuel each day, some scale was looked for, but after 21 days' run the boiler was opened and found perfectly free of all earthy deposit, and, with the exception of a small amount of oily matter along the water line, as clean as when put in service. The fuel was Cumberland coal.

The arrival of the machinery was an event in the history of Key West, and was viewed with great curiosity as it came over the steamer's side. The landing of the big boilers created much excitement among the natives, who at once began to speculate on the manner of transportation from the wharf to the station, nearly a mile away. Heavy teaming was unknown, consequently there was no truck strong enough to carry the boilers on the island. They were, therefore, placed on cradles mounted on skids and trundled very slowly—about half a mile a day—through the streets on rollers, with the aid of a tackle and a pair of mules. Previous to the arrival of these engines and boilers the entire steam power on the island amounted to about 15 horse-power.

The poles used for the line are cypress, shipped in from Tampa by vessel. As the island is a mass of coral rock, all holes for the poles, with the exception of places once a salt marsh and now filled in, were dug with steel-pointed bars; costing from 75 cents to $2 each, according to the hardness of the rock. Layers of flint were often struck, and where this occurred an entire day was consumed in getting one hole down to the required depth. In the lower part of the town, which was at one time a salt marsh and filled in, the earth was too soft to hold the poles, and the tide flowing in the gutters of the streets, kept the ground soaked. Barrels were sunk in which the poles were placed, and broken stone was tamped in. The lower end of the poles was coated with asphaltum and the remainder painted. Twenty-five lightning arresters were placed in different parts of the lines.

Kite-flying is one of the amusements, and indulged in as much by grown persons as by youngsters, and in a short time the lines were festooned with all manner of kites and kite-tails, and for blocks at a stretch the wires were pulled together. An ordinance was passed by the city council imposing a fine of $5 against kite-flying and the police were instructed to arrest all violators. A short time before the plant went into operation men were sent out and the lines were cleared. Many schemes were tried to remove the wrecked kites, but the most effective was with a torch on the end of a long pole.

On December 24 last, the engines turned over for the first time. It had been announced some weeks previously that the town would have the lights on Christmas Eve, and a large crowd of people gathered at the station to see if it was possible to make a lamp burn without oil and with a wick that looked like a piece of iron. At seven o'clock the engines were started, five minutes later the switch was turned and in an instant the station was in a blaze of light, while cheer after cheer went up from the motley crowd. The light was at once popular and orders came in so rapidly that the line force was increased and lines were extended as fast as possible. The street lighting has been done by private subscription. The price for arc lights is $4.50 and incandescent lamps are 50 cents per week, all night lighting. The plant has cost about $70,000. It was installed by Mr. H. P. Loring, for the Thomson-Houston Company and Mr. C. W. Hansen for the Ball Engine Company, Erie, Pa. Almost the entire expense has been borne by Mr. Philbrick, through whose efforts Key West has one of the finest electric plants in the South and the lighting of a coral reef has been accomplished.

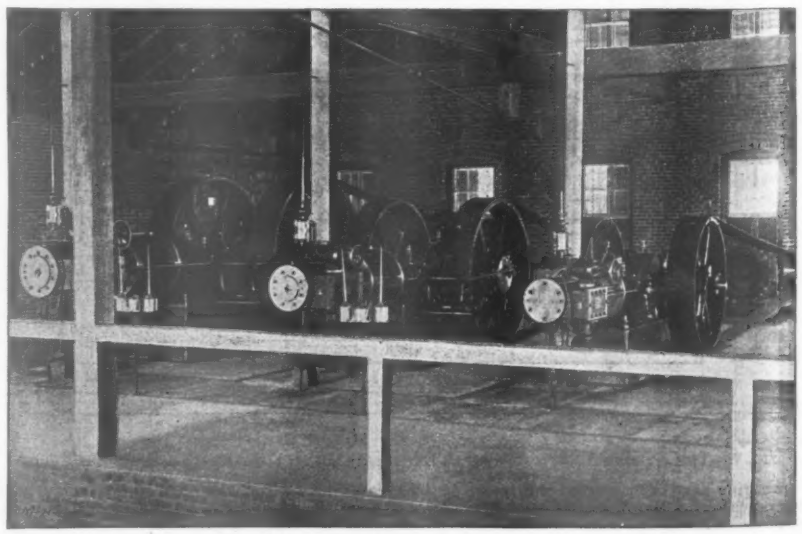


FIG. 2.—INTERIOR VIEW OF ENGINE ROOM OF THE ELECTRIC LIGHT STATION AT KEY WEST, FLA., SHOWING ENGINES MADE BY THE BALL ENGINE COMPANY, OF ERIE, PA.

Whipple Held in $3,000.

Fred H. Whipple, who is charged with swindling electrical concerns all over the country, including several in Massachusetts, was before the district court at Pittsfield, Mass., on October 3, and was held in $3,000 for the grand jury.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

BOONE, IA.—The Boone Electric Street Railway and Light Company; capital, $200,000. L. W. Reynolds, president; Eli H. Chanden, vice-president; C. F. Rice, treasurer; S. T. Stanfield, general manager. The company is to build five miles of street car line and furnish light and power to consumers.

THOMASVILLE, GA.—H. J. Bettis, of Atlanta, representing the Atlanta Consolidated Street Railway, is organizing a company for the purpose of building a street railway here.

SCRANTON, PA.—A Philadelphia syndicate, which includes Edward E. Denniston, John P. Ilsey and James Richardson, Jr., has arranged for the purchase of all the electric lines of the People's Street Railway Company. As soon as the charter is granted, the syndicate will assume charge of the road under the name of the Scranton Traction Company.

LONG ISLAND CITY, N. Y.—The Steinway and Hunters' Point Railway Company is an applicant for permission to extend its road and substitute electricity for horse-power.

PROVIDENCE, R. I.—The Union Railroad Company has been granted a franchise to equip its entire street railway system with electric power.

LOCK HAVEN, PA.—The Lock Haven Electric Street Passenger Railway Company has been granted a franchise to construct several miles of street railway at this place.

NEW HAVEN, CONN.—The State Street Horse Railway Company; Samuel R. Blatchley, president, has applied for permission to change its motive power to electricity.

NORWALK, O.—Wood & Wilcox, of Sandusky, who are interested in the Sandusky, Huron and Milan Electric Railroad Company, are urging the people of this town to have the road built to Norwalk. The stockholders ask that $15,000 in stock be subscribed for that purpose, the road to be extended to Norwalk from Milan, *via* east Norwalk.

LOCKPORT, N. Y.—Right of way has been secured for an electric road from this city to Olcott. It it said that the same company, consisting of New York and Lockport capitalists, will build an electric street railway in this city.

WATERDOWN, CAN.—A meeting of the Citizens of Waterdown and adjoining towns, was held recently, for the purpose of discussing the advisability of aiding in the construction of an electric railway from Hamilton to Guelph, *via* Waterdown.

HANOVER, PA.—The Hanover and McSherrystown Railroad Company; capital stock, $30,000. The proposed road will be three miles in length, and will be operated by electricity. Directors, John C. Tanger, A. H. Melhorn and T. E. Ebrehard, of Hanover, Pa., and C. D. Smith, of McSherrystown.

ATLANTIC CITY, N. J.—The Atlantic Ocean Railway Association; capital $100,000. The object of the company is to build an electric railroad along the Beach from the inlet to Albany Avenue, a distance of about four miles. The incorporators are E. G. Styron, Henry D. Longacre, James R. Clark, Wm. S. Keen and Chas. C. Coulter, all of Camden.

COLORADO SPRINGS, COLO.—The Midland Terminal Railway Company, has increased its capital stock to $250,000.

SAVANNAH, GA.—A new electrical railway to extend through the property of the West End Improvement Company is projected.

NANTAHALA, LA.—Chas. Beech is surveying an electric railroad for the Nantahala Marble and Talc Company.

PITTSTON, PA.—A charter has been granted for the Pittston Electric Street Railway Company, with a capital stock of $150,000. The incorporators are A. B. Brown, Ed. Barrett, Albert Brown, Dr. C. J. Barrett, Thomas English, Ed. Rutledge, John Mullin and C. F. Bohan, of Pittston, and Thomas Shay, Esq., of Nanticoke, and John Harding, of Wilkes-Barre. The road will be built from the foot of Broad street to Cork Lane, and thence to Avoca, Moosic, Duryea, Junction, Sebastapool, Port Griffith, Inkerman, Plainville and Port Blanchard. It is an entirely new company and the old company will have to take a back seat.

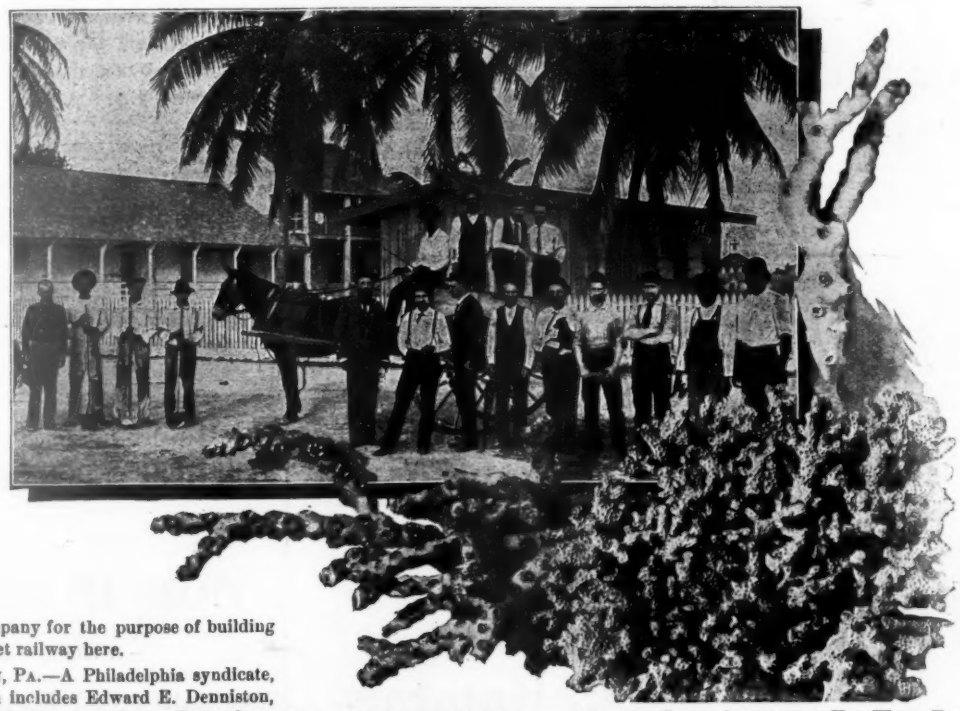


FIG. 3.—ERECTING FORCE OF THE ELECTRIC LIGHT COMPANY AT KEY WEST, FLA.

Electric Light and Power.

BOARDMAN, WIS.—The New Richmond Electric Light and Power Company has been granted a franchise by the council to build and operate an electric light and power plant. The contract will be let at once.

BLOOMFIELD, N. J.—A number of New York and Newark capitalists have organized the Bloomfield Electric Light and Power Company to supply Bloomfield and Montclair with electric light.

BATAVIA, N. Y.—The board of aldermen of this village have decided to ascertain the cost to the village of putting in a municipal plant.

ST. PAUL, MINN.—Articles of incorporation have been filed by the New Richmond Light and Power Company with $10,000 capitalization. The contract will be let at once for the street lighting. The central plant will be located in the water works building now being constructed, and in connection with which it will be operated.

NEW ORLEANS, LA.—The Capitol Railway and Lighting Company has been chartered here with a capital of $150,000. The board of directors consists of Messrs. W. J. Knox, O. B. Steele, Ben. R. Mayer, of Baton Rouge; E. H. Farras, of New Orleans; Rorison, McDonald and Hawthorne, of the Fort Wayne, Ind., Company. Mr. B. R. Mayer was elected president, Capt. O. B. Steele vice president, and Mr. W. J. Knox secretary and treasurer. The new company is organized to purchase the plants of the Baton Rouge Street Railway and the Citizens' Electric Light and Power Company and run them in conjunction. The deal is one of the most important consummated in Baton Rouge in recent years. Improved and more extensive and powerful machinery will be placed in the electric plant, with the view of furnishing better lighting to the city and private consumers, of providing electric power about the city, both day and night, and of running the street cars by electricity. The track and other appurtenances of the railway company will at once be put in the best repair, and the line possibly extended down Front street for the convenience of persons going to the railroad depot and the steamboat landings. The capitalists interested are the same who recently purchased the Crescent City Railway and the Edison Electric Light Company of New Orleans.

SYRACUSE, N. Y.—The plans for the new power house and plant of the Syracuse Electric Light and Power Company, which have recently been completed by the engineering department of the Thomson-Houston Electric Company, demand the expenditure of $250,000. The equipment will be forty-four 200 horse-power boilers and six 1,000 horse-power engines. In the dynamo room there will be five 4,000 light incandescent machines, twenty-nine 50 light arc machines, twelve 2,000 light incandescent machines, and sixteen 100 horse-power railroad power generators.

COVINGTON, IND. — Covington Light and Power Company; capital, $50,000. Promoters, Wm. S. Reed, Chicago, Ill.; Geo. M. Snyder, Noblesville, Ind.; and Pierre Gray, Indianapolis, Ind.

MARION, ILL.—Marion Electric Light and Street Railway Company; capital, $20,000. Promoters, J. C. Mitchell, Wm. H. Warder, W. H. Bundy.

NEVADA, IA.—Nevada Electric Company; capital, $18,000. Promoters, T. L. Seevers, E. P. Kennedy, M. M. Seevers.

MONTREAL, CAN.—The Royal Electric Company is to have a rival in the Central Electric Light Company, the capital stock of which is $500,000. The company proposes to supply electric light and power throughout the city.

NEW YORK CITY.—The General Incandescent Arc Light Company; capital stock, $250,000. Directors, Sigmund Bergmann, Philip A. Klein, and Paul M. Mowrey, of New York City.

REDFORD, VA.—The City Council has granted an exclusive franchise to Mount & Jones, for the erection and operation of an electric light and power plant.

SHELBYVILLE, KY.—The trustees have appointed L. C. Willis, W. A. McGrath, and M. J. McCludkey, a committee to confer with the construction companies regarding the practicability of an electric light plant here.

DOWNERS GROVE, ILL.—The Downers Grove Electric Light and Power Company; capital stock, $15,000. Incorporators, W. A. Tope, C. H. Dicke, and Frederick H. Ayer.

WEST DULUTH, MINN.—The Electric Light Company has purchased a new 50 light Thomson-Houston dynamo, and will increase its arc light circuit.

CLINTON, WIS.—The Standard Electric Company; capital $20,000. Incorporators, Lewis Lousk, H. Woodard, and E. Oppermann.

NORTH HEMPSTED, N. Y.—Henry M. Kibbee, of Brooklyn, and others have made application to the board of town trustees for permission to erect poles and string wires for electric lighting purposes.

NEW RICHMOND, WIS.—The contract for a complete system of arc and incandescent electric lighting for this city has been awarded to the Northwestern General Electric Company.

ROCKVILLE, CONN.—At a special city meeting, it was decided to establish a municipal electric light plant. The total number of votes cast was 618, of which 431 were cast in favor and 187 against the city running its own plant.

ROCHESTER, N. Y.—The Citizens' Light and Power Company has been incorporated, with a capital stock of $150,000, to furnish electricity for public and private purposes in Rochester.

BERKELEY, CAL.—Berkeley Electric Light, Power and Heat Company; capital stock, $50,000. Promoters A. A. Osborn, W. E. Sell, J. M. Whitworth, F. M. Cunningham, Jno. G. McCredy.

HUMMELSTOWN, PA.—A charter has been granted to the Hummelstown Electric Light, Heat and Power Company; capital, $10,000. The incorporators are Allen Walton, F. J. Shaffner, M. K. Brubaker and W. C. Baker.

KINDRED INTERESTS

Young Men.—In the majority of cases it is the young man who is actively connected with electrical development. This is especially true of Philadelphia; there successful young men in the electrical business abound. We are glad to record the sales made by young men of the concern of Pepper & Register, of the Provident Building, Philadelphia, which are as follows: Easton and Phillipsburgh Railroad, 13 miles, Westinghouse system; a plant in the University of Pennsylvania, at Philadelphia, five engines and five dynamos; 1,000 light plant in the Camden, N. J., Masonic Temple Theatre; 800 lights in Y. M. C. A., Trenton, N. J.; 1,500 lights in Union League Club, Philadelphia, Waddell-Entz system.

W. R. Brixey, Manufacturer of Kerite Insulated Wires and Cables.

Mr. W. R. Brixey, whose name has been so long associated with the Kerite products, has issued the following announcement:

"Having succeeded to the celebrated Day's Kerite insulated wire and cable business, I beg to state that after a close and personal study, both as superintendent and general manager for 14 years in the manufacture of the same, I am prepared to supply wires, cables and tapes of the highest standard.

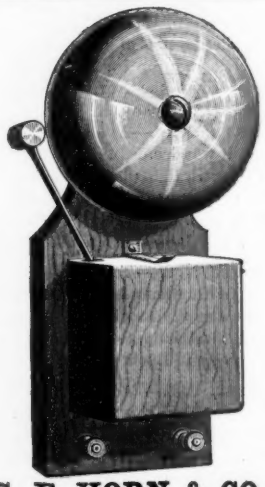
"My personal experience in each part of this business enables me to meet the wants of customers in every detail, and I bespeak a continuance of favors so generously accorded in the past."

The ELECTRICAL REVIEW congratulates Mr. Brixey on his assumption of the role of proprietor, and wishes him every success. Mr. Brixey's offices are in the *Mail and Express* building at 203 Broadway.

WANTED—
15 ARC LIGHT DYNAMO.

New or second hand. Must be all complete and in perfect working order.
Address, CHAS. P. WILLARD & CO.,
Clybourn and Southport Avenues,
CHICAGO.

GEO. W. CHURCH. JAS. E. SLEIGHT.
GROBET FILES, HUBERT'S FRENCH
P. S. Stub's Files, EMERY PAPER,
TOOLS, Horse-Shoe
Steel, Magnets
CHURCH & SLEIGHT
IMPORTERS,
TOOLS, METALS & SUPPLIES
109 109 FULTON ST. NEW YORK. 109
ADDIS'S TWIST
CARVING TOOLS. DRILLS,
CHESTERMAN'S WM. SMITH & SON,
TAPES AND RULES. MUSIC WIRE.



G. E. HORN & CO.,
Manufacturers and Jobbers of
ELECTRIC BELLS,
63 So. Canal St., Chicago, Ill., U. S. A.
SHALL WE SEND YOU OUR ILLUSTRATED PRICE LIST?

THE ONLY ONE.

The Chicago, Milwaukee & St. Paul Railway is the only line running solid Vestibuled, Electric Lighted and Steam Heated trains between Chicago, Milwaukee, St. Paul and Minneapolis.

The Chicago, Milwaukee & St. Paul Railway is the only line running solid Vestibuled, Electric Lighted and Steam Heated trains between Chicago, Council Bluffs and Omaha.

The Chicago, Milwaukee & St. Paul Railway Company now operates over sixty-one hundred miles of thoroughly equipped road in Illinois, Wisconsin, Northern Michigan, Minnesota, Iowa, Missouri, South and North Dakota.

On all its through lines of travel, the Chicago, Milwaukee & St. Paul Railway runs the most perfectly equipped trains of Sleeping, Parlor and Dining Cars and Coaches. The through trains on all its lines are systematically heated by steam. No effort is spared to furnish the best accommodations for the least money, and, in addition, patrons of the road are sure of courteous treatment from its employés.

CHANDLER, FFRENCH & CO.,
1st NATIONAL BANK BUILDING,
KANSAS CITY, KANSAS.

ELECTRICAL SECURITIES.

Buy and sell Electric Light and Street Railway Bonds.
Promote and contract for the construction of Electric Light Plants and Street Railways.
Correspondence solicited.

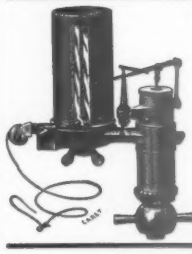
MACHINERY IN STOCK.

Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 68 in. x 31 ft.; 96 in. x 20 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 16 in. x 6 ft. Turret Lathes, 1¼ in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.
5 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ½ in to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
C. D. and E. Horizontal Boring Machine. Newark Machine Tool Co.
Send for List of New and Second-Hand Machinery in Stock.
PRENTISS TOOL & SUPPLY CO., P. O. Box 3362,
115 Liberty Street, New York.
59 South Canal St., Chicago, Ill.

Hulbert Bros. & Co. St. Louis, Mo.
Artistic Metal Workers.
Brass, Iron and Wire Office-work.
Railings, Crestings, Moldings, etc.
Everlasting Cemetery FENCE.
Shipped everywhere. Agents wanted.
Write for Catalogue and Estimates.

ROBB MACKIE,
Consulting Electrical Engineer,
NEAVE BUILDING,
CINCINNATI, O.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.



PRACTICAL TESTS OF STEAM, ELECTRICAL AND ALL OTHER POWER PLANTS.
GEO. H. MORRISON,
ENGINES INDICATED.
POWER WEIGHED.
No. 6 FEDERAL ST., BOSTON.

EVERYBODY WHO HAS OCCASION TO USE A
Portable Ammeter OR Voltmeter,
Either for Laboratory or Commercial Testing, a universal instrument, so to speak, wants a good one at reasonable cost.
QUEEN & COMPANY, of Philadelphia,
Are issuing a circular on the subject, No. 355, which contains valuable information and special prices.
ASK THEM FOR A COPY.

Daniel W. Baker. Cyrus O. Baker, Jr.
BAKER & CO.,
Importers, Melters and Refiners of
PLATINUM,
408, 410, 412 and 414 N. J. R. R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased.

P AND B
Insulating Compounds,
Armature Varnish,
Insulating Tapes,
Compounds for all kinds of iron work
THE STANDARD PAINT CO., 2 Liberty Street, New York.
Sole Manufacturers P. & B. Roofing, Papers, etc.

TWO NEW BOOKS.

TRANSFORMERS.

Their Theory, Construction and Application Simplified.

By CARYL D. HASKINS.

A book of especial value to the Central Station Electrician, the Student and the Investigator. Written in a clear, simple and interesting manner.

DIAGRAMS AND ILLUSTRATION.

150 PAGES. PRICE, $1.25.

—— THE ——
Practical Management
— OF —
DYNAMOS AND MOTORS
— AND —
Localization and Remedy of Troubles in Dynamos.

By FRANCIS B. CROCKER and SCHUYLER S. WHEELER.

Simple directions for the practical use and management of dynamos and motors.

ILLUSTRATED.

100 PAGES. PRICE, $1.00.

Sent to any address on receipt of price.

Electrical Review Publishing Co.,
13 PARK ROW,
P. O. Box 3329. New York.